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Mechanization in Problem Solving

The Effect of *Einstellung*

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THE PROBLEMS

SEVERAL problems, all solvable by one somewhat complex procedure, are presented in succession. If afterwards a similar task is given which can be solved by a more direct and simple method, will the individual be blinded to this direct possibility?

If a blinding effect does result, will it be of characteristically different strength in groups that differ in educational level, age, etc.? Moreover, if we introduce means to save the subjects or to rescue them from such blindness, will these means readily work? Will they operate differently in various groups?

And what may be the real cause for the blinding effect? How are we to understand this phenomenon?

MECHANIZATION IN PROBLEM SOLVING

THE EFFECT OF *EINSTELLUNG*

CHAPTER I

THE MAIN EXPERIMENTS

SECTION 1

A. Introduction

THE problem with which the present experiment is concerned was first investigated in the Berlin Institute of Psychology by Zener and Duncker. These experiments, which were preliminary in character, have not been published, the only published reference to them being the following passage in an article by N. R. F. Maier:

"Zener, in some preliminary experiments at the Psychological Institute of the University of Berlin, in 1927, habituated his subjects to solve certain types of problems in the same way. A test problem was then given. He found that an obvious and simple solution of the test problem was usually overlooked because the characteristic method of solution, set up in the preceding problems, was used in the test problem. Control groups tended to solve the problem in the obvious and simple manner."[1]

It seemed important to conduct further experiments of this kind because the quoted findings of these preliminary experiments appeared to show clearly an interesting result: The successive, repetitious use of the same method mechanized many of the subjects—blinded them to the possibility of a more direct and simple procedure. We wished also to extend the scope of the method and to use various groups of subjects, children as well as adults. Furthermore, we wished to ascertain whether, if a tendency to repeat the habitually used method did develop, a change in response would be brought about if some factors to work against the habituation were employed.

Under the sponsorship of Professor Max Wertheimer,[2] the writer, in 1936, experimented with various sets of problems and finally selected the following, which are similar to those utilized by Zener and Duncker in Berlin; however, for theoretical and practical purposes, problems 9, 10, and 11 and a special "instructed group" were added. The problems selected may be shown in tabular form.

Problem		Given the Following Empty Jars as Measures			Obtain the Required Amount of Water
1		29	3		20
2	E_1*	21	127	3	100
3	E_2	14	163	25	99
4	E_3	18	43	10	5
5	E_4	9	42	6	21
6	E_5	20	59	4	31
7	C_1	23	49	3	20
8	C_2	15	39	3	18
9		28	76	3	25
10	C_3	18	48	4	22
11	C_4	14	36	8	6

* An explanation of these letters will be furnished later.

B. Our Basic Exploratory Experiment[3]

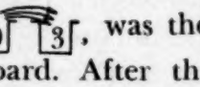
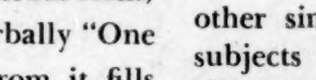
The problems were tried out in an ex-

[1] N. R. F. Maier, *Reasoning in Humans*, Journal of Comparative Psychology. Vol. 2, No. 1, (1936) p. 127.

[2] Professor Max Wertheimer furnished us with more specific information about the Berlin experiments mentioned in Maier's article.

[3] Unless otherwise stated in the text, it should

ploratory experiment conducted, in 1936, in one of Professor Max Wertheimer's seminars at the Graduate Faculty of the New School for Social Research. Graduate students, college instructors, and research workers composed this select group of 15 people, of whom many possessed the Ph.D. or M.D. degree.

The experimenter told the class that its task was to figure out on paper how to obtain a required volume of water, given certain empty jars for measures. To illustrate this principle we presented Problem One. The subjects were asked for the solution, and the method of solving the problem  , was then written on the blackboard. After this, Problem Two was put on the blackboard, 21 127 3 get 100! After 21½ minutes the subjects were asked for their solutions. The answer was then illustrated in both a written and verbal form; viz,  and verbally "One fills the 127-quart jar and from it fills the 21-quart jar once and the 3-quart jar twice. In the 127-quart jar there then remain the 100 quarts of water."

Without any further interruptions the other problems, in succession, were presented one at a time on the blackboard, at intervals of 2½ minutes—or oftener, if the students had required less time for the problem.

The method which solves Problem Two also solves Problems Three through Six; the solution which is applicable to these five problems may be described as:  or: "Fill the middle jar, and from it fill the jar to the right twice and the jar to the left once, leaving the required amount of water in the center jar." Or we may state the method as $B - A - 2C$, if we designate the jars, in the order written, as A, B, and C, respectively.

This $B - A - 2C$ method may also be used in Problems Seven and Eight. But Problem Seven may be solved more simply by subtracting 3 from 23 $(A - C)$, and Problem Eight by adding 3 to 15 $(A + C)$. Of eleven New School subjects (we shall speak first of those eleven who received only the instructions given above) all employed the circuitous method—$B - A - 2C$. Not one subject used the more direct method in Problems Seven and Eight. Having become habituated to the mode of solution ($B - A -$ 2C), they used it in the succeeding similar problems. Later, when they were shown the more direct method after the whole experiment was completed, the subjects spontaneously said more or less passionately, "How dumb I was;" "How stupid of me;" "How blind I was;" or made other similar comments. A few of the subjects saw the light themselves—after the experiment.

Before any problems were presented, four other members had been taken outside of the classroom and had been told, in the absence of the eleven subjects whose results were reported above, "After returning to the classroom you will get a number of problems. After you will have completed Problem Six, write on your papers the words, *'Don't be blind!'*" In some cases this warning appeared to be effective: 5 of their 8 answers to Problems Seven and Eight showed the direct method of solution. Three of their answers, in spite of the warning, showed only the tedious $B - A - 2C$ procedure.

Problems Ten and Eleven possessed the same ambiguity as Problems Seven and Eight. Before Problem Ten, we had introduced the ninth problem which could not be solved in the $B - A - 2C$ manner but could easily be solved by

be understood that all experiments reported herein were conducted by the writer himself.

$A - C$, taking 3 away from 28. Would it disrupt the tendency to repeat blindly the $B - A - 2C$ method and bring about the more direct solution of Problems Ten and Eleven? A comparison of the per cent of solutions of Problems Ten and Eleven with the per cent of solutions of Problems Seven and Eight yielded an increase of 15 per cent direct solutions in the former for the 11 subjects who had not received the warning, "Don't be blind," and an increase of 12 per cent for the "Don't be blind" subjects. To this degree Problem Nine seemed effective.

C. Explanation of Terminology

In line with tradition, the habituation to the repeatedly used procedure (in this case the $B - A - 2C$ method) will be called an *Einstellung*.[4] Problems 2, 3, 4, 5, and 6 are then "Einstellung (E) problems" which may generate an "Einstellung Effect" for the subsequent "critical test problems" (7 and 8), which, if the Einstellung operated, would be solved in the Einstellung (E) method, $B - A - 2C$, and not in the more simple and direct fashion designated as the D–Method. C_1 and C_2 will henceforth refer to the Critical Test Problems Seven and Eight, respectively, and similarly, C_3 and C_4 to Problems Ten and Eleven, respectively.

Those subjects who received the instruction, "Don't be blind," (DBB) will be called the DBB group, and those who did not receive this warning, the Plain group.

1. The Einstellung Effect (E-Effect) may be seen in:

a) How many E ($B - A - 2C$) and how few D solutions the Plain group had of C_1C_2. This might be termed the "pure" E-Effect since neither the "Don't be blind" instruction nor Problem Nine was here operating.

b) How many E– and how few D–solutions the DBB group had of C_1C_2. These results, however, may have been complicated by the instruction, "Don't be blind."

2. The Effect of Problem Nine[5] may be seen in:

a) How E–solutions decreased and D–solutions increased in C_3C_4, as compared with C_1C_2 in the Plain group.

b) How E–solutions decreased and D–solutions increased in C_3C_4, against C_1C_2 in the DBB group. The "Don't be blind" instruction, however, may have influenced the results.

3. The "Instruction Effect" may be seen in:

a) How much less E– and how much more D–solutions in C_1C_2 the DBB group had, as against the Plain group's solutions of these problems.

b) How much less E– and how much more D–solutions in C_3C_4 the DBB group had, as compared with C_3C_4 in the Plain group. Here the results may have been complicated by the preceding Problem Nine.

4. The extremes in E-Effect are, on the one hand, in C_1C_2 in the Plain group, and, on the other hand, in C_3C_4 in the DBB group, where the DBB instruction and the after-effect of Problem Nine may have worked against "pure" E-Effect.

[4] *Einstellung* is "the set which immediately predisposes an organism to one type of motor or conscious act." H. C. Warren, *Dictionary of Psychology*, New York: Houghton Mifflin Co., (1934) p. 371. For the various meanings of "set" see James I. Gibson, *A Critical Review of The Concept of Set in Contemporary Experimental Psychology*, Psychological Bulletin, Vol. 38, No. 9, (1941).

[5] Problem Nine, the reader will recall, could not be solved by the $B - A - 2C$ method, but could be solved by the more direct $(A - C)$ method. Would it disrupt the Einstellung and cause more D solutions of C_3C_4 than there had been in C_1C_2?

To facilitate the comparison of results, we employ a percentage basis in describing them.

In the above-described preliminary experiment, for example:

1a)[6] The pure E-Effect was 100 per cent E– and 0 per cent D–solutions. That is, every one of the 11 subjects of the Plain group solved C_1C_2 in the E–manner ($B - A - 2C$); none of these C_1C_2 problems were solved by the more direct method.

1b) The E-Effect in the DBB group was 37 per cent E– and 63 per cent D–solutions.

2a) The Effect of Problem Nine on the following C_3C_4 was 15 per cent in the Plain group. In other words, the Plain group had 15 per cent less E– and 15 per cent more D–solutions in C_3C_4 than in C_1C_2.

2b) In the DBB group the Effect of Problem Nine on the following C_3C_4 was 12 per cent.

3a) Instruction Effect in C_1C_2 was 63 per cent. That is, the DBB group had 63 per cent less E– (more D–solutions), in C_1C_2 than the Plain group.

3b) In C_3C_4 the Instruction Effect was 60 per cent.

4) The pure E-Effect (C_1C_2 of Plain group) was 100 per cent E– and 0 per cent D–solutions, whereas when both the "Don't be blind" warning and Problem Nine had been introduced (C_3C_4 of DBB group), there were only 25 per cent E–solutions and 75 per cent D–solutions.

In short, in this little experiment the E-Effect was very large. The increase in D–solutions after Problem Nine was presented was 15 per cent for the Plain group and 12 per cent for the DBB group. The Instruction Effect was 63 per cent in C_1C_2, 60 per cent in C_3C_4. Thus, the preliminary experiment showed a large E-Effect and considerable decreases of E–solutions and increases in D–solutions, after both the "Don't be blind" instructions and Problem Nine were presented.

[6] 1a, 1b, 2a, etc. correspond to the numbers of the preceding paragraphs.

SECTION 2

The procedure employed in the preliminary experiment was tried out in a number of other groups in order to have a larger number of subjects tested and to make it possible to study the responses of various groups: college classes, classes of Adult Education students, high-school classes, elementary-school classes, etc.

We added, in these subsequently described experiments, first only for some classes, and later for all, a Control group to which the E–problems, 2-5, were not given but in which Problem One was immediately followed by C_1, C_2, Problem Nine, C_3, C_4. This was done in order to ascertain how these problems would be solved, in these groups, when not preceded by the E–problems.

A. Experiments with College Groups

We had the opportunity to experiment with 222 students of Brooklyn College: four classes of seniors (aged 20 to 21), one of which served as a Control group; two classes of juniors (aged 18 to 20); and two classes of Freshmen (aged 17 to 18), one of which served as a Control group, all of them constituted a select group with respect to scholastic ability, since the college has high admittance requirements. With the exception of three minor changes, the method of conducting the experiment was similar to that used in the exploratory experiment.

1) Before the experiment began, the

members of the class were told that it would be necessary to send some of them into the hallway where they were to wait quietly till recalled. Then every other subject alternately was sent out into the hallway. In this way, half the class was left in the room, the other half kept outside. The subjects remaining in the classroom constituted the DBB group, those outside the Plain group.[7] While the Plain group was in the hallway, the DBB group was told:

> When the others come back into the room, both you and they will be given the same instructions and information about the experiment. However, I want to give you a hint which will help you in the experiment. Remember, don't tell the others what I am going to tell you.
>
> In this experiment you are going to solve some problems. When you finish the sixth problem write the words, "Don't be blind," on your papers. This is to make you aware of the fact that you must be cautious; you must watch out and see that you do not act foolishly while solving the subsequent problems. Remember, it is to remind you to be awake, to look so that you will not act like a blind person who can't see what he is doing.

The group was asked, "What do you write; when do you write it?" The DBB group was then assembled in one half of the room and again cautioned against telling the others. The Plain group was recalled and seated in the empty half of the room.

2) In presenting the illustrative problem and E_1, we told the subjects explicitly that they must not guess nor approximate, that no other jars might be used for measures, that they might use any of the given jars to obtain the water.

3) After showing them the E method of solving E_1, $127 - 21 - 3 - 3 = 100$, we showed another method, which entailed the use of only two jars, $127 - (9 \times 3) = 100$.

The results of the college groups are shown in Table I.

1a) *Pure E-Effect (% E and D in C_1C_2 of Plain group as compared with Control group[8]).* Every Control group subject employed the D– and not the E–method in C_1C_2, whereas in each Plain group about ¾ or more of the subjects repeated the E method in solving these two problems.

1b) *E-Effect in DBB group (% E and D in C_1C_2 of DBB group).* The E-Effects were smaller, but in spite of the warning, "Don't be blind," a considerable number of these subjects (⅓ to ⅔ of each group) were blind to the D method.

Just as in the New School group, there were in the DBB and Plain groups, after the completion of the experiment, a number of spontaneous outbursts. That some of the subjects suddenly realized, during the experiment, that there was a simpler method of solution was seen in the statements they wrote on their papers and in their facial expressions or gestures while solving Problem Nine, C_3, or C_4.

2a) *Effect of Problem Nine in Plain group on C_3C_4 (% D^9 C_3C_4 of Plain group–% D C_1C_2 of Plain group).* Every college Plain group had more D solu-

[7] Because of the procedure used in obtaining the DBB and Plain groups, the two were about equal with respect to average age and educational level in the college classes, and in all subsequently described classes. Since I.Q.'s were not available for most of these college classes, we do not know how the two halves compare in this respect. See p. 95, however, for a description of the I.Q.'s of the elementary school Plain and DBB groups.

[8] As a result of selection, the groups which served as "controls" were similar, in age and educational level, to the Freshman and Senior experimental groups; but with regard to their I.Q.'s, we have no data. See page 95, however, for the I.Q.'s of the elementary school Control Groups.

[9] Henceforth we shall describe the Effect of Problem Nine and the Instruction Effect in terms of the increase in D solutions only, rather than in terms of both the increase in D and the decrease of E solutions.

TABLE 1

Group	Number of Subjects*		% E Solutions†				% D Solutions†			
Control‡	Plain	DBB	Plain		DBB		Plain		DBB	
			C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4
(Sen.)	(27)		(0)	(0)			(100)	(100)		
(Fr.)	(30)		(0)	(0)			(100)	(100)		
Sen. 1	13	14	77	73	61	39	23	27	39	61
Sen. 2	14	20	82	64	50	25	14	36	50	75
Sen. 3	15	15	70	27	37	13	30	73	63	87
Jr. 1	12	10	100	84	50	19	0	16	50	81
Jr. 2	10	12	85	75	67	46	15	25	33	54
Fr. 1	15	15	77	63	70	40	23	37	30	63

* The DBB and Plain groups do not in every case have an equal number of subjects. This was brought about in some classes by the exclusion of late-comers who arrived while the DBB instructions were being given, and who were added to the Plain group, thus increasing the number in this "half." At other times, some subjects in the hallway wandered off and did not enter with the main body of the Plain group, thus decreasing the number in this "half."

† Some (relatively few) answers to a test problem clearly showed that the subject had employed the E or D method but, because of a mistake in calculation, had not arrived at the correct answer. We decided to include such responses in the tabulation of the results; as an E–solution, if the work clearly showed that the E–method was used, as a D–solution, if the work clearly showed the D–method was used. Since the E and D categories, so defined, include almost all answers, their sum is usually 100 per cent. Where they do not total 100 per cent, the difference between their sum and 100 per cent should be considered as composed of responses which indicated clearly that a method other than E or D was employed, or which showed complete failure to solve the problem.

‡ To facilitate comparison, we placed the results of the Control groups in the Plain group column, with parentheses around their results to set them off from the others.

tions of C_3C_4 than they had in C_1C_2. The per cent increases for the groups, arranged in the order of Table 1, were

Sen. 1	*Sen. 2*	*Sen. 3*	*Jr. 1*	*Jr. 2*	*Fr.*
4	22	43	16	10	14.

2b) *Effect of Problem Nine on C_3C_4 in DBB groups (% D C_3C_4 of DBB group −% D C_1C_2 of DBB group).* The DBB groups, too, showed increases of D solutions in C_3C_4 as compared with C_1C_2.

Sen. 1	*Sen. 2*	*Sen. 3*	*Jr. 1*	*Jr. 2*	*Fr.*
22	25	24	31	21	33.

3a) *Instruction Effect on C_1C_2 (How much more D the DBB groups had in C_1C_2 as against the Plain groups' solutions of C_1C_2).* Each DBB group had more D solutions of C_1C_2 than its corresponding Plain group. The per cent increases in D solutions for the various college groups were.

16 36 33 50 18 7.

3b) *Instruction Effect on C_3C_4 (How much more D in C_3C_4 of DBB group than in C_3C_4 of Plain group).* In C_3C_4, every DBB group had more D solutions than the Plain groups; the difference in per cent of D solutions were

34 39 14 65 29 26.

4) The pure E-Effects (C_1C_2 of Plain group), were

% E:	77	82	70	100	85	77
% D:	23	14	30	0	15	23.

When both the "Don't be blind" instruction and Problem Nine had been introduced (C_3C_4 of DBB group), the responses were

% E:	39	25	13	19	46	40
% D:	61	75	87	81	54	63.

5) *Summary.* Every one of the six college groups had a large E-Effect: from 70 to 100 per cent E of C_1C_2 in Plain group; whereas the senior and freshman

classes that served as Control groups had 0 per cent E and 100 per cent D solutions of these problems. The changes in D solutions, after Problem Nine was presented, ranged from 4 to 43 per cent for the Plain group and from 21 to 33 per cent for the DBB group. Instruction Effects showed that the various DBB groups had from 7 to 50 per cent more D solutions of C_1C_2 and from 14 to 65 per cent more D solutions of C_3C_4 than their corresponding Plain groups. Thus we may conclude that the six college classes to which this experiment was administered had a large E-Effect and showed, on the whole, considerably more D solutions after Problem Nine and the "Don't be blind" warning were presented.

B. *Experiments with Adult Groups*

Another group of subjects to which the experiment was administered was composed of 913 adults who were attending classes conducted by the Adult Education Project of the city of New York. Roughly speaking, there were three kinds of groups:

1. Four groups of 305 regular academic high school students whose ages ranged from 16 to 17, who were attending W.P.A. summer commercial classes. Two groups (45 subjects) served as Control groups.

2. Seven groups of 442 adults who had not attended college but who were commercial high-school graduates. Their ages ranged from 19 to 30, and they were employed as clerks, typists, and salespeople. Two of these classes (151 students) served as Control groups.

3. Four adult groups whose 166 members were mainly housewives who had not gone beyond elementary school. Their ages ranged from 38 to 40. Two of the classes, composed of 75 subjects, functioned as Control groups.

1. *High-School Seniors*

First let us examine the results obtained in classes composed of academic high-school seniors shown in Table 2.

TABLE 2

Group	Number of O's			% E Solutions						% D Solutions					
	Control	Plain	DBB	Control		Plain		DBB		Control		Plain		DBB	
				C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4
H.S. Sen. 1	15	28	27	0	0	89	82	89	78	97*	97*	11	18	11	22
H.S. Sen. 2	30	100	105	0	0	73	63	60	43	92*	92*	27	37	40	57

* That these are not 100 per cent D is due to some failure to solve the problems.

1a) *Pure E-Effect (% E and D in C_1C_2 of Plain groups as against C_1C_2 of Control groups).* Whereas not one Control-group subject employed the E–method, about ¾ and 9/10 of the Plain–group subjects solved C_1C_2 by the E–method. Only about 1/10 and 3/10 of their answers were in the D–manner.

1b) *E-Effect in DBB groups (% E and D in C_1C_2 DBB).* A considerable number of DBB subjects used the E–method: about 9/10 and ⅗ of the subjects used the E–, about 1/10 and ⅖ of the subjects used the D–method in C_1C_2.

2a) *Effect of Problem Nine in Plain groups (% D C_3C_4–% D C_1C_2).* There were 7 and 10 per cent more D–solutions of C_3C_4 than of C_1C_2.

2b) *Effect of Problem Nine in DBB groups (% D C_3C_4–% D C_1C_2).* D solutions in C_3C_4 were 11 and 17 per cent larger than D–solutions in C_1C_2.

3a) *Instruction Effect on C_1C_2 (% D DBB group–% D Plain group).* For H.S. Sen. 1, the Instruction Effect was 0 per cent; that is, the DBB group had the same per cent of D–solutions (11 per cent) as the Plain group. But the H.S. Sen. 2 DBB group had 13 per cent more D of C_1C_2 than its Plain group.

3b) *Instruction Effect on C_3C_4 (% D DBB group–% D Plain group).* The H.S. Sen. 1 DBB group had 4 per cent more and the H.S. Sen. 2 DBB group had 20 per cent more D–solutions of C_3C_4 than their respective Plain groups.

4) Whereas the pure E-Effects (C_1C_2 of Plain group) were 89 and 73 per cent E–solutions, 11 and 27 per cent D–solutions, the responses made when both the "Don't be blind" instruction and Problem Nine had been introduced (C_3C_4 of DBB group) were 78 and 43 per cent E–solutions, 22 and 57 per cent D–solutions.

5) *Summary.* The two groups composed of high–school seniors showed a large E-Effect (89 and 73 per cent E in C_1C_2 Plain) in contrast to the two Control groups which had 0 per cent E. In the Plain groups there were 7 and 10 per cent more D–solutions after Problem Nine; in the DBB groups, the increases were 11 and 17 per cent. The Instruction Effects were 0 and 13 per cent on C_1C_2 and 4 and 20 per cent on C_3C_4. Thus these groups, too, showed large E-Effects and considerably more D–solutions after Problem Nine was presented. But for the first time we find 0 per cent Instruction Effect in a group.

2. *Adult Commercial High–School Graduates*

Let us now examine the manner in which the commercial high-school graduates solved the critical test problems as shown in Table 3.

TABLE 3

Group	Number of 0's		% E Solutions				% D Solutions			
			Plain		DBB		Plain		DBB	
	Pl.	DBB	C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4
Control	(86)		(0)	(0)			(99)	(100)		
Control	(65)		(0)	(0)			(100)	(100)		
H.S. Ad. 1	40	30	76	68	57	33	24	32	43	67
H.S. Ad. 2	29	30	72	70	48	38	26	30	52	62
H.S. Ad. 3	22	23	69	59	65	41	30	41	35	59
H.S. Ad. 4	30	25	77	63	56	36	23	37	44	64
H.S. Ad. 5	30	32	98	82	83	41	2	18	17	59

1a) *Pure E-Effect (% E and D solutions in C_1C_2 of Plain groups as against C_1C_2 of Control groups).* Again the Control groups' solutions showed the D– and not the E method in contrast to the Plain groups': more than ⅔ of the subjects in each Plain group used the E method, less than ⅓ used the D method.

1b) *E-Effect in the DBB groups (% E and D in C_1C_2 of the DBB groups).* In the DBB groups we find fewer E– and more D solutions, but still about ½ or more E solutions of C_1C_2.

2a) *Effect of Problem Nine in Plain groups (% D C_3C_4–% D C_1C_2).* Every high-school adult Plain group had more D solutions of C_3C_4 than of C_1C_2. The groups had the following increases in D:

8 4 11 14 16.

2b) *Effect of Problem Nine in DBB groups (% D C_3C_4–% D C_1C_2).* In the DBB group the increases were:

24 10 24 20 42.

3a) *Instruction Effect on C_1C_2 (% D C_1C_2 DBB group–% D C_1C_2 Plain group):*

19 26 5 21 15

3b) *Instruction Effect on C_3C_4 (% D C_3C_4 DBB group–% D C_3C_4 Plain group):*

35 32 18 27 41

4) The pure E-Effects in each group were:

% E:	76	72	69	77	98
% D:	24	26	30	23	2.

When both Problem Nine and instruction DBB were introduced, the responses were:

% E:	33	38	41	36	41
% D:	67	62	59	64	59.

5) *Summary.* The commercial high-school adult groups showed a considerable E-Effect (69 to 98 per cent E–solutions in C_1C_2 Plain), in contrast to the Control groups in which there were 0 per cent E–solutions. The increases of D–solutions, after Problem Nine, ranged from 1 to 16 per cent in the Plain groups and from 10 to 42 per cent in the DBB groups. The DBB groups had from 5 to 26 per cent more D–solutions in C_1C_2 and from 18 to 41 per cent more D–solutions in C_3C_4.

On the whole, as in most of the previous groups, there were large E-Effects and some increase in D–solutions after Problem Nine, and in the DBB groups.

3. *Adult Public School Graduates*

Table 4 shows the results of the adult groups whose members had been graduated from public elementary school but had not continued their formal education.

TABLE 4

Group	Number of O's			% E Solutions						% D Solutions					
	Control	Plain	DBB	Control		Plain		DBB		Control		Plain		DBB	
				C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4
P.S. Ad. 1	30	15	16	0	0	93	51	28	16	100	100	7	49	72	84
P.S. Ad. 2	45	30	30	0	0	95	83	72	41	100	100	5	17	28	59

1a) *Pure E-Effect (% E– and D–solutions in C_1C_2 of Plain groups as against C_1C_2 of Control groups).* Whereas every Control-group subject employed the D–method in C_1C_2, more than $9/10$ of the subjects in both Plain groups used the E–method and not the D–method.

1b) *E-Effect in the DBB groups (% E and D in C_1C_2 of DBB groups).* A little more than $1/4$ of the subjects in one group and about $3/4$ of the subjects in the other DBB group solved C_1C_2 by the E–method.

2a) *Effect of Problem Nine in the Plain groups (% D C_3C_4–% D C_1C_2).* In the Plain groups the increases of D–solutions were 42 and 12 per cent.

2b) *Effect of Problem Nine in the DBB groups (% D C_3C_4–% D C_1C_2).* In the DBB groups the increases of D–solutions were 12 and 31 per cent.

3a) *Instruction Effect on C_1C_2 (% D solutions C_1C_2 DBB–% D solutions C_1C_2 Plain).* The two DBB groups had 65 and

23 per cent more D–solutions of C_1C_2 than their Plain groups.

3b) *Instruction Effect on C_3C_4 (% D C_3C_4 DBB–% D C_3C_4 Plain).* The DBB groups gave 35–and 42 per cent more D–solutions of C_3C_4 than the Plain groups.

4) The pure E-Effects (C_1C_2 Plain) were

% E: 93 95 % D: 7 5.

When instruction DBB and Problem Nine had been introduced (C_3C_4 DBB) the responses were

% E: 16 41 % D: 84 59.

5) *Summary.* Whereas the two Control groups had 0 per cent E–solution, the E-Effect was large in the Plain groups of the adults who were public-school graduates (93–and 95 per cent E–solutions in C_1C_2 in the Plain groups). The increases in D–solutions after Problem Nine were 42 and 12 per cent in the Plain groups and 12 and 31 per cent for the DBB groups. The DBB groups had 65 and 23 per cent more D–solutions of C_1C_2 and 35 and 42 per cent more D–solutions of C_3C_4 than the Plain groups.

The E-Effects were high and, as in many of the previous groups, there was an increase of D–solutions after Problem Nine, and in the DBB groups.

C. Experiments with Public School Groups

Adults have thus far been the only subjects whose responses have been described. We administered the experiment to 1,259[10] pupils of three Brooklyn public schools. The ages of the subjects ranged from 9 to 14 years. (See p. 95 for I.Q.'s.) In every school one or two classes were used in each of the fourth-, fifth- and sixth-grade levels to serve as Control groups;[11] the remaining classes of these grade levels were used as experimental groups.

Certain variations were made in the procedure. We assured the children that this was an experiment, not a school test, that their teachers and principal would not see the papers, and that it would in no way affect their scholastic standing.[12] Before the presentation of the problems, the children were told of how the old-fashioned grocer measured out milk into one's milk pail by employing dippers. "If he had a 1 quart and a ½ quart dipper, how would he get 1 quart of milk, 2 quarts, 1½ quarts, etc.?" They were told, "Imagine you are selling milk, you have as measures, a 5, 2, 1, and a 7 quart dipper, how would you get 9 quarts of milk, 3 quarts, 10 quarts, etc.?" Emphasis was laid on the fact that neither guess-work nor approximation entered into the grocer's measurements, or should it enter into theirs. While they were solving these problems, it was pointed out that they might not approximate, that they might not use jars other than those given.

[10] Actually there were 1,552 subjects, but we used in this section only those (1,259) subjects who solved at least E_1E_5. See pp. 15 ff for others. For the previously-discussed groups, the results of all the participating subjects were presented because the five E problems were solved by almost every subject.

[11] The method of selection was such that the Control groups were equivalent to the experimental groups in age and educational level. With regard to intelligence, it was found that the average I.Q. scores (based on the National Intelligence Tests) of the Control groups were somewhat lower than those of the Plain groups. A comparison of the Plain with the DBB groups showed that the Plain group had a smaller average I.Q. than the DBB group. (See page 95) These slight disparities of the average I.Q.'s, far from constituting an uncontrolled variable in the experiment contribute, as will be seen, to the clearness of the results.

[12] This was done because the results of some preliminary experiments seemed to show that nervousness, tenseness, and "test attitudes" in the children might work strongly for mechanized responses in the test problems of the experiment (cf. pp. 49 ff).

As in the previously-described experiments, the class was then divided into two halves, and one-half of the pupils functioned as a "Don't be blind" group. In all subsequent respects, the elementary school children received the same instructions as the adult and college groups.

The children's solutions of the test problems are shown in Table 5.

TABLE 5

Group	Number of Subjects*			% E Solutions†						% D Solutions†					
	Control	Plain	DBB	Control		Plain		DBB		Control		Plain		DBB	
				C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4
P.S. A4	29	31	27	0	0	84	81	70	75	83	83	13	19	22	22
P.S. A5	26	45	38	2	0	85	86	88	92	81	88	10	12	9	8
P.S. A6	36	45	41	1	0	72	72	90	89	82	100	23	22	5	9
P.S. B4	34	41	37	0	0	62	62	73	77	88	91	24	28	23	23
P.S. B5	28	42	32	0	0	68	56	61	55	100	100	31	44	38	45
P.S. B6	31	67	41	1	0	88	85	82	80	90	100	11	9	18	20
P.S. C4	36	38	29	0	0	70	71	78	74	79	89	20	20	21	26
P.S. C5	119	53	64	1	0	67	66	50	66	82	86	30	34	37	34
P.S. C6	110	67	66	3	0	52	55	56	59	88	93	44	45	42	41

* Since we excluded from the results those subjects who had not solved E_4E_5, the subjects remaining in the DBB and Plain groups were not always equal in number.

† Because of the failure of a subject to solve a critical (his work did not indicate that an E or D method had been employed; see Table 1) the E and D solutions do not, in all cases, total 100 per cent.

1a) *Pure E-Effect (% E and D in C_1C_2 Plain as against C_1C_2 of the Control groups).* A large number of D–solutions was given by the Control groups: from 79 to 100 per cent D–solutions of C_1C_2.[13] In the Plain groups, a considerable E-Effect was shown: from 52 to 88 per cent E–solutions, and only from 10 to 44 per cent D–solutions.

1b) *E-Effect in the DBB groups (% E and D C_1C_2 DBB).* The E-Effects in the DBB groups were, on the whole, similar to the Plain groups' range: from 50 to 90 per cent E–solutions; from 5 to 42 per cent D–solutions. Similarly, as in the previous experiments with the adults, the pupils in these classes when shown the D–solution to some critical, after the experiment, exclaimed, "I was stupid," "I did not see it," etc. Unlike what had occurred in the groups previously discussed, it was but rarely that we observed in the P.S. groups spontaneous outbursts, after the experiment, of "Oh! How blind I was," "How dumb I was," or the gestures, facial expressions, and comments written on the test papers to indicate that the subject had discovered for himself the D–method.

2a) *Effect of Problem Nine in the Plain groups (% D C_3C_4–% D C_1C_2).* We found very little change in C_3C_4 as compared to C_1C_2. The small changes we did find were statistically unreliable. The differences were:

6 2 —1 4 13 —2 0 4 1.

2b) *Effect of Problem Nine in the*

[13] Where the D solutions did not equal 100 per cent, it was due to a few subjects' attempts to solve a critical by a method other than E or D or to some E solutions of a critical.

DBB groups (% D C_3C_4–% D C_1C_2). We found essentially the same results in the DBB groups:

0 −1 4 0 7 2 5 −3 −1.

These results are indeed startling when we recall that until we considered the public school groups' results, we had found considerable positive changes.

3a) *Instruction Effects (% D C_1C_2 DBB–% D C_1C_2 Plain).* In some groups there was little positive Instruction Effect, in others none, and in one group even a strong negative effect; viz:

9 −1 −18 −1 7 7 1 7 −2.

3b) *Instruction Effects (% D C_3C_4 DBB–% D C_3C_4 Plain).* Again, in some groups there was little increase, in another no effect, and in still another a clear negative effect; viz:

3 −4 −13 −5 1 11 6 0 −4.

4) The first line in Table 5a contains the pure E-Effect (C_1C_2 Plain), the second line shows the responses made when both the instruction factor and Problem Nine had already been introduced (C_3C_4 DBB).

TABLE 5a

	% E Solutions									% D Solutions								
C_1C_2 Pl.	84	85	72	62	68	88	70	67	52	13	10	23	24	31	11	20	30	44
C_3C_4 DBB	75	92	89	77	55	80	74	66	59	22	8	9	23	45	20	26	34	41

The numerical values of D–solutions reached when both Problem Nine and DBB had been introduced, were not consistently higher than the values reached without them in the Plain group.

When both Problem Nine and DBB were presented, 50 per cent or more D–solutions was made by every one of the previous groups, with the exception of H.S. Sen. 1 which had 22 per cent D–solutions. In the public school classes, the per cent D–solutions in C_3C_4 of the DBB groups were 22, 8, 9, 23, 45, 20, 26, 34 and 41; all are below 50 per cent; a number of them are very small, some even smaller than the values made by the corresponding Plain groups.

5) *Summary.* In the public-school classes there were considerable E-Effects (from 52 to 88 per cent E–solutions of C_1C_2 in the Plain group). In the Control groups, the E–solutions ranged from 0 to 3 per cent; in absolute numbers, only 8 of the 898 responses to C_1 and C_2 were in the E–manner. We found little recovery effect—no consistent reliable increases in D–solutions were brought about by Problem Nine or by the DBB instruction. There were even a few cases of considerable negative operation of DBB. What are the reasons for this result? We shall return to this question on page 18.

D. Experiments with a Private Elementary School Group

We also administered the experiment to 40[14] children whose ages ranged from 8 to 12 and who constituted the pupil body of the 4th, 5th, and 6th grades of a progressive private elementary school in Brooklyn. They were superior in I.Q. to the public school subjects (see page 95). The experimental procedure was similar to that used in the public schools, but we had no control group.

[14] Only 29 subjects' responses are here considered because the others did not do E_4 and E_5. In the fourth year less than half of the class were able to solve any of the problems. The teacher told us that the group had not yet had much formal arithmetic instruction and that they were, therefore, below par when considered in light of the achievement of public school children. Also, in the fourth and fifth years a number of subjects solved E_4 in this manner, 9 + 6 + 6 = 21. Since it was not the E method, they were excluded from the results.

The solutions to the critical test problems are shown in Table 6.

TABLE 6

Number of O's		% E Solutions				% D Solutions			
		Plain		DBB		Plain		DBB	
Pl.	DBB	C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4	C_1C_2	C_3C_4
13	16	69	62	56	50	31	38	44	50

1a) Pure E-Effect was 69 per cent E and 31 per cent D solutions.

1b) E-Effect in the DBB group was 56 per cent E and 44 per cent D solutions.

2a) Effect of Problem Nine in Plain group (% D C_3C_4–% D C_1C_2) was 7 per cent.

2b) Effect of Problem Nine in DBB group (% D C_3C_4–% D C_1C_2) was 6 per cent.

3a) Instruction Effect (% D C_1C_2 DBB –% D C_1C_2 Plain) was 13 per cent.

3b) Instruction Effect (% D C_3C_4 DBB –% D C_3C_4 Plain) was 12 per cent.

4) The pure E-Effect was 69 per cent E solutions, 31 per cent D solutions. After both recovery factors had been introduced there resulted 50 per cent E and 50 per cent D solutions.

5) *Summary.* Again we found large E-Effects (69 per cent E solutions Plain C_1C_2), but on the whole, somewhat less than in the public schools. Effects of Problem Nine and DBB instruction were not very high, but positive. In the DBB group there was quite a high level of D solutions as against the results in the public schools.

E. Experiments in New York University

All the above described experiments were performed in the year 1936-1937. In 1938, Professor E. R. Wood proposed application of the experiment in several New York University classes which consisted mainly of teachers and administrators of the elementary and secondary schools of New York City. There were 275 subjects, whose ages ranged from 19 to 52. The results are shown in Table 7.

TABLE 7

	Number of Subjects			% E Solutions						% D Solutions					
				Control		Plain		DBB		Control		Plain		DBB	
	Control	Pl.	DBB	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4	C_1 C_2	C_3 C_4
NYU_1	98	17	18	0	0	82	75	64	50	93	100	18	35	36	50
NYU_2	95	16	20	0	0	100	78	63	52	95	100	0	22	30	48
NYU_3		43	29			79	60	50	41			19	40	48	59

1a) *Pure E-Effect.* The two Control groups showed 0 per cent E solutions; the pure E-Effect was in all groups considerably high: from 79 to 100 per cent E solutions in C_1C_2 of the Plain groups.

1b) *E-Effect in DBB groups.* In the DBB groups, under the working of instruction, there was still between 50 and 64 per cent E solutions.

2) *Effect of Problem Nine (% D C_3C_4 −% D C_1C_2).* In both the Plain and DBB groups there were more D solutions in C_3C_4 than in C_1C_2.

a) Plain:	17	22	21
b) DBB:	14	18	11

3) *Instruction Effect.* The DBB group had more D solutions than the Plain group.

a) % D C_1C_2 DBB−% D C_1C_2 Plain:	18	30	29
b) % D C_3C_4 DBB−% D C_3C_4 Plain:	15	26	19

4) The Pure Einstellung Effect (C_1C_2 Plain) was

% E:	82	100	79
% D:	18	0	19.

The level reached by the working of both DBB and Problem Nine (C_3C_4 DBB) was

% E:	50	52	41
% D:	50	48	59.

5) *Summary.* The results were, on the whole, similar to the results of the adult and college groups of the previous experiments.

SECTION 3

A Crucial Decision

We saw that most subjects, under the influence of the Einstellung, used the complicated E method in C_1C_2 and not the more direct (D) method. One might argue, in line with some theoretical attitude, that there is nothing wrong in using the E method in the critical test problems since this method does result in the correct answer, and may be quicker under these circumstances. The tendency to repeat the E method, the argument might continue, rather than being a hindrance is an aid since it gives a ready, accurate, and speedy response. Thus Einstellung or habituation would be an effect of considerable strength, which is in no way a bad thing.

First of all, many subjects who employed the E method in C_1C_2 or C_3C_4, upon discovering the D method, or being shown it at the completion of the experiment, were excited about how foolish and blind they had been.

But besides this qualitative evidence, we have in our experimental set-up a possibility to test whether the habituaton to the E method is a real hindrance or not. We have spoken so far of Problem Nine only in terms of a task introduced for the sake of producing D solutions in the following critical problems, C_3C_4. Problem Nine was solvable by the direct method ($A - C$) but not by the E method ($B - A - 2C$). What about the result in Problem Nine itself? Would the solution of this simple problem be hindered by the existing habit? Would the results of the experimental groups (as against the Control groups) show that perhaps Problem Nine was not so easily solved?

Before going on to the report of the results of Problem Nine, we must confess that the situation seemed to us to be very dramatic. If the results should show that subjects able to solve more difficult problems (E_1, E_2, for example) were hindered in solving Problem Nine, it would indicate an undoubtedly bad effect of habit.

We confess that we had some expectation in this direction, but the quantitative results showed not merely some influence of this kind on only a few subjects, but a very strong influence indeed.

How many persons, in per cents, were not able to solve the comparatively simple Problem Nine within the allotted time of 21½ minutes, in contrast to the subjects' solutions of Problem Nine in the Control groups?

Every group's result cited above points directly to the fact that the Einstellung,

the tendency to repeat the E method in subsequent problems, was clearly a hindrance, preventing a large number of subjects from solving a problem which Control group subjects solved. On the basis of these results, and in connection with the observations reported on page 14, this formulation seems appropriate: *Einstellung—habituation—creates a mechanized state of mind, a blind attitude toward problems; one does not look at the problem on its own merits but is led by a mechanical application of a used method.* Thus the habituation—*Einstellung*—produced in Problem Nine a surprising failure to solve a simple problem, in the same way as it blinded subjects to direct solutions in the previously discussed critical problems.

TABLE 8

Per cents failure to solve Problem Nine

Name of Groups*	Control	Plain	DBB
New School		82	25
Coll. Sen. 1	0	61	29
Coll. Sen. 2		50	25
Coll. Sen. 3		27	17
Coll. Jr. 1		58	33
Coll. Jr. 2		70	29
Coll. Fr. 1	0	67	47
H.S. Sen. 1	0	68	60
H.S. Sen. 2	0	80	76
H.S. Ad. 1	0	62	28
H.S. Ad. 2	0	59	43
H.S. Ad. 3		64	43
H.S. Ad. 4		73	40
H.S. Ad. 5		70	47
P.S. Ad. 1	0	80	50
P.S. Ad. 2	0	83	57
P.S. A 4	17	84	67
P.S. A 5	12	87	87
P.S. A 6	0	60	78
P.S. B 4	9	66	65
P.S. B 5	0	64	34
P.S. B 6	0	76	76
P.S. C 4	11	68	69
P.S. C 5	14	55	55
P.S. C 6	7	39	39
Pr.El.		57	37
N.Y. U. 1	0	65	56
N.Y. U. 2	5	81	45
N.Y. U. 3		53	38

* For number of subjects in each group see the previous tables dealing with the solutions of C_1C_2, C_3C_4.

SECTION 4

The Variation of the E-Effect with the Number of E Tasks Solved

The report of the results of the public school groups (pages 12 to 13) included only those subjects in each group who had solved at least E_4E_5, the last two E problems. The fact that in the public schools some subjects solved all the E problems, some solved a few, and some none, presented us with the possibility of determining whether the E-Effect varied accordingly. If it did, we should expect that the following would be true:

1. The Control groups, since they were not given the E tasks before the criticals, should have the least E-Effect; i.e., the most D solutions of C_1C_2, the least failures of Problem Nine.

2. There were pupils in the experimental groups who, although they were given all the E problems, solved none of them. We might expect that these "Did No E" group subjects would not show E-Effects. However, the "Did No E" group represents a selection of subjects who were attempting to apply the E method on the basis of the demonstration at the beginning; in C_1C_2 some may finally have succeeded in using it. Some of these subjects, manifesting already in the E tasks a general inability to solve the problems, may also have failed in the D problems. If the above were true, it would result in the "Did No E" group subjects having slightly larger E-Effect than the Control group subjects; i.e., less D solutions of C_1C_2, and more failures of Problem Nine.

3. The largest E-Effect should be manifested by those pupils who solved all five E problems, ("Did All E" group).

4. Somewhere in between those who did none and those who did all of the E problems, fall the pupils who solved some but failed to solve others of the E problems. We presented, on pages 11 to 14, the E-Effects of only those pupils who solved at least the last two E problems, E_4E_5. This "Did E_4E_5" group includes both those who solved all five E problems and those who failed to solve one or more of the first three E problems. We should expect the "Did E_4E_5" group to show somewhat smaller E-Effects than the "Did All" group, since the former contains subjects who did not solve some of the E tasks.

5. The group of subjects that did not solve E_4E_5 includes both those who did none of the E problems, and those who did one or more of the first three E problems. Thus, the E-Effect of the "Did Not Do E_4E_5" group should be somewhat larger than that of the "Did No E" group, since in the former are pupils who did solve some E tasks.

In short, if the E-Effect varied with the number of E problems solved, we should find an increase in the E-Effect as we go from group to group when in each class the subjects are arranged in this order: Control group subjects, "Did No E" group, "Did Not Do E_4E_5" group, "Did E_4E_5" group, and "Did All E" group.

Table 9 contains the E-Effects reached in each of the above-named categories. The E-Effect is given in terms of the per cent D solutions of C_1C_2, and the per cent failures of Problem Nine made by the Plain and Control groups.[15] The number in italics indicates the number of subjects in the group.

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[15] We omit the results of the DBB subjects because of the complicating factor of the additional instruction.

TABLE 9*

School Level	P.S.A.						P.S.B.						P.S.C.						PR.El					
	4th		5th		6th		4th		5th		6th		4th		5th		6th		4th		5th		6th	
Solution Problem	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9	% D C_1 C_2	% F #9
Control	*29*		*26*		*36*		*34*		*28*		*31*		*36*		*119*		*110*							
O's	83	17	81	12	82	0	88	9	100	0	90	0	79	11	82	14	88	7						
"Did No E"	*24*		*8*										*18*		*6*		*11*							
O's	77	20	56	25									85	28	83	0	77	36						
"Did No E_4E_5	*32*		*10*				*4*		*3*				*28*		*11*		*13*							
O's	64	33	45	47			62	0	50	50			66	29	77	0	77	38						
"Did E_4E_5"	*31*		*45*		*45*		*41*		*42*		*45*		*38*		*53*		*67*				*6*		*5*	
O's	13	84	10	87	23	60	24	66	31	64	11	76	20	68	30	55	44	39			42	67	30	40
"Did All E"	*13*		*37*		*44*		*18*		*21*		*12*				*19*		*14*							
O's	12	85	3	90	9	77	17	76	28	67	4	83			21	64	39	50						

* We have omitted from the table all groups composed of less than three subjects; there were two such cases in "Did No E" group," four in the "Did No E_4E_5," and one in "Did E_4E_5," and "Did All E." The results of these small groups were, on the whole, in accordance with the others.

On the whole, with some few exceptions—which are not reliable because of the range of deviations and the small number of subjects in these groups—our predictions held true. In general, the per cent of D solutions decreases (the E-Effect increases) as we go from a group in which fewer of the five E tasks were solved to a group in which more of the E problems were solved. We have not here, however, an answer to the question of whether or not, and how, the amount of E-Effect varies with the number of E problems. An answer to such a question must be obtained by systematically employing in different groups various numbers of E problems.[16] But our crude groupings do show that the dealing with the critical test problems in the E manner, and the failure to solve Problem Nine are related to the previous E solutions. The correctness of the predictions thus makes for the reliability of the method employed in this experiment.

[16] In some of our preliminary experiments (see pages 38-41) we did this and found the same tendency for a positive relationship between E-Effects and number of E problems solved. Professor S. E. Asch has since corroborated this result in experiments conducted with Brooklyn College students.

SECTION 5

Concerning the Qualitative Data

Aside from the quantitative results reported on above, we obtained data which are qualitative in nature. The experimenter jotted down notes on the subjects' behavior during the experimental session and wrote them out in detail immediately after leaving the room. Subjects of their own accord sometimes wrote comments on their papers after a problem. In each class new papers were distributed after the experiment and the subjects asked to write what they thought was the purpose of the experiment and how they felt while participating in it. The DBB group subjects were asked to write what they thought was meant by the instruction, "Don't be blind." Wherever time permitted the D method was then illustrated and subjects were requested to indicate why they had not used it. The data collected through these means constitute the qualitative results to which we shall occasionally refer in appropriate places in the subsequent sections.

Chapter II

Discussion of Some Questions Raised in the Main Experiments

SECTION 1

Why Did the Public School Children Show No Clear Positive Recovery Effects?

We found considerable positive recovery effects in the adult and college groups but not in the public-schools groups. There, recovery was zero or slightly above or slightly below zero; the results, in general, fluctuated around the zero point. The reasons for the apparent ineffectiveness of the recovery factors are not wholly clear. However, on the basis of our observations and impressions, we offer the following hypothesis: The children repeated the E method in all the problems because they thought that the experiment was a test, or that it was a lesson in arithmetic, and carried over to it attitudes developed by the methods of teaching employed in the schools.[17]

The above hypothesis does not account for the cases of considerable negative DBB instruction effect. A possible explanation suggests itself in the answers of some of the children to the question, "What does DBB mean?" These children said, "'Don't be blind' means don't bother trying to find a method in each problem, just do what you did before."; "Don't be blind to the rule which solves all the problems."; etc. They did not take DBB as a challenge to do some thinking of their own, to drop the habituated method in favor of a better one, or to see the possibility of solving the problems by the D method; their interpretation was contrary indeed.

The foregoing are only preliminary remarks. More research will have to be performed before we shall be in a position to know what was responsible for the lack of recovery in the public schools.

SECTION 2

Relation of Age, Educational Level, and I.Q. to the Results

We shall omit the explicit statistics on the relation of age, educational level (amount of formal education), and I.Q. to the results of the present experiments; instead, we shall confine ourselves in this report to the following statements.

1. All the reported groups, whether young or old, whether with little education or much, showed large E-Effects. Neither were the E-Effects great only in the groups of old subjects and small in the groups of young subjects, nor the opposite. Neither were they great in groups of subjects who had little education and small in groups of highly educated subjects, nor the opposite.[18]

Such was not the case with regard to recovery. We found that, on the whole, the public school groups had little positive recovery effects, whereas the adult and college groups had considerable re-

[17] Some evidence for the hypothesis is seen in the speed-test experiments, pages 53-57. Also refer to the description of school activities on pages 90 ff. In connection with the apparent ineffectiveness of Problem Nine to produce more D solutions in C_3C_4, we wish to point out that 26 per cent of the elementary school subjects whose results were reported used the E method even in Problem Nine, writing as an answer, $76 - 28 - 3 - 3 = 42$ or $76 - 28 - 3 - 3 = 25$.

[18] Moreover, when we fractionized all the subjects in each school into age groups and in turn fractionized the age groups into groups of similar education, no consistent variation was found between the results and age or educational level.

covery effects. But, here too it does not seem to be merely a question of age and educational level; for example, the fifth year P.S. B had as much Experimental Extinction Effect as the adult and college groups and Pr.El. had as much Instruction Effect as some adult and college groups. With regard to the question of why there was no recovery in the public school groups, see page 18.

Later on, in the additional experimental variations (pages 38-86), we shall again see that the factors introduced to reduce or minimize E-Effects were more effective in the college groups than in the public schools. Comments of the subjects in these additional experiments indicated that differences in attitudes towards and interpretations of their tasks and instructions, rather than sheer differences in age or educational level, were influential in producing the differences in results.

It seems to us that such factors as attitudes toward the experiment are complicating the results, so that no clear picture of the relationship of E-Effects or recovery to age and educational level can be obtained.

2. Is it that a high I.Q. makes for small E-Effects, a low I.Q. for large E-Effects, or the opposite? The adult and college groups will not be considered in this discussion because I.Q.'s were not available for them. For the P.S. and Pr.El. groups, I.Q.'s were available and offered the possibility of studying the relationship of I.Q. to the results of the present investigation. One of our procedures was the following: The subjects of each school, after having been grouped according to age, were fractionized into three I.Q. groups; I.Q.'s of 110 and above, I.Q.'s from 90 to 110, and I.Q.'s below 90, which are referred to as High, Middle and Low I.Q. groups, respectively. We shall omit the explicit results of this study, because there were no substantial, clear cut differences in E-Effects one way or the other. This much seems clear: large E-Effects were found in High I.Q. groups and in Low I.Q. groups. The Middle I.Q. groups tended to have a little or even less E-Effect than the High I.Q. groups. All these differences, however, were very small and not statistically significant.

We did not find any striking differences in recovery between the various I.Q. groups. The High I.Q. groups, as a whole, showed a slight superiority. But in some age levels and in some schools the High I.Q. groups had less recovery than the Middle, and in a few cases, less than the Low I.Q. groups.

The problem is complicated by the fact that in the public schools of our experiment the children were grouped according to I.Q.'s ("homogeneous groupings"), so that the method of teaching, and even—at times—the curriculum, was adjusted to the child's I.Q. Certain differences aside from the I.Q. therefore existed between the low and high I.Q. classes, and they might have influenced the results.

The lower I.Q. groups tended to get more drill work than the brighter children. They usually were below par in the "tool subjects" and, in an attempt to bring them up to the norm for the grade, the teacher frequently resorted to isolated drills. Some of the teachers believed that only by dint of repetition could they "knock any knowledge into the dull heads." The remedial drill classes in reading and arithmetic obtained the greater part of their clientele from the lower I.Q. groups.

In some low I.Q. classes teachers had to spend so much time in drilling on the fundamentals that little or no time could

be devoted to those aspects of arithmetic which involve more creativity. For example, in one school problem-solving was omitted from the curriculum for the dull fifth grade children so that more time could be spent on exercise in the fundamentals.

In the high I.Q. classes we found that the children usually participated more directly in the learning process. Teachers sometimes permitted them to derive methods of solution and gave them explanations of the procedures. Since the pupils mastered the fundamentals in a shorter time, work of a more creative type, for example, "original problems," could be given to them.

Furthermore, there usually was a striking difference in attitude between the dull and bright groups. We had the impression when we entered a "dull class" (I.Q.'s generally below 90) that we were in some kind of prison. The children, usually retarded a term or more, seemed resentful or resigned. There was a kind of deadness in the room, a lack of spontaneity in response, and at times, particularly at the beginning of the experiment, a decided lack of interest.[19] The teachers of a few of these classes told us of the necessity of ruling with an iron hand. It was often a strain to conduct the experiment in the atmosphere of tension and fear which existed in these groups. The brighter classes, in sharp contrast, usually were freer, livlier, and happier, and from the beginning of the experiment manifested much interest.

Any correlation between I.Q. and E-Effects based on our data, would, therefore, necessarily be a spurious one, since it would not be clear whether it were an index of the relationship between E-Effect and I.Q., or between E-Effect and more drill, certain personal attitudes, and certain social conditions. Thus, from our present data, no conclusive statement can be made as to the relation of I.Q. to E-Effect.

In this connection, we have to point out that subjects of superior intelligence and education (graduate students, university professors) developed E-Effects as great as or even greater than did children of low educational level and I.Q. (but recovery was better for the superior people). These results, coupled with the subjects' comments and behavior, lead us to suspect that there are certain factors in high intelligence and certain factors in low intelligence which may make for E-Effect. Superior people, because of their greater facility at generalizing, may hastily infer that the E method is the method to be used; they may regard it as clever to develop a formula which permits them to solve the problems without much effort spent; they may look with contempt at such childish tasks, and deal with the problems in a superficial manner; they may desire to show how quickly they can solve the problems; they may be better able to comprehend whole situations and thus view a test problem as a uniform member of a homogeneous whole, and solve it in the E way. Correspondingly, there may be factors in people of low intelligence contributing to E-Effect; for example, a certain rigidity and inelasticity which characterizes much of their behavior,[20] a feeling of fear and insecurity which may make them stick to the E method, once they hit upon it.

It appears to us that experimental

[19] This behavior might be in part a result of the I.Q. It might also be a product of the method of teaching, and in general, of the individual's and others' reactions to his low intelligence.

[20] K. Lewin, *A Dynamic Theory of Personality*, New York: McGraw-Hill Co., (1935) Chapter VII, pp. 194-238.

studies to discover these factors are needed, for they may well lead to a deeper understanding of the relationship between intelligence and the results.

The study of the correlation of age, educational level, and I.Q. to E-Effect and recovery has to be continued. Thus far, with our data, the techniques we employed revealed no striking correlations.

SECTION 3

Discussion of the Private Elementary School's Results

We noticed on page 13 that the Private Elementary School (Pr.El.) had less E-Effect than the public schools, considered as a whole. Of course, comparing the 29 Pr.El. pupils to 1,259 public school pupils is hazardous. Nevertheless, the difference in results does raise some important problems.

The Pr.El. differed from the public schools in two important respects: (1) the I.Q.'s of its children were higher than those of the public school children (see page 95); (2) the method of teaching employed in Pr.El. was of a more progressive nature than that used in the public schools.[21] The question thus arises whether the difference in E-Effect was a consequence of the difference in I.Q. and/or the difference in teaching methods. To answer, we need to know: (1) What is in general the relationship of I.Q. to E-Effect? We have dealt with this matter in a previous section (see page 19). (2) How do the progressive methods of teaching affect the E-Effect? With this question we shall now concern ourselves.

In order to determine whether progressive methods of teaching favor less E-Effect it is necessary to have two schools that are equated for all personal and social factors but differ in the methods of teaching—one using "drill methods" and the other some of the modern "activity methods."[22] Not having a school which is equated in all important respects but teaching methods to Pr.El., we cannot draw any conclusive decisions as to whether or not the progressive pedagogical practices of the latter led to its smaller E-Effects.

Nevertheless, some evidence in favor of progressive educational procedures is seen when we compare P.S. A to P.S. C. These schools were approximately similar with respect to the nationalities, socio-economic level, and I.Q.'s (see page 95) of their school populations. They differed, however, in the methods of teaching they employed. In P.S. A few or none of the progressive methods were used; in P.S. C some modified "activity methods" had been introduced in all but the "tool subjects." A comparison of the results of those pupils in both schools who solved all the E problems (see page 16) showed that P.S. C had less E-Effect than P.S. A (but recovery effects, on the whole, were equally small in both schools).

The difference in E-Effect between the two schools may be a product of certain

[21] The three public schools did not all employ similar teaching methods. P.S. A., with the exception of some individual teachers, used traditional drill methods of teaching; P.S. B. also employed traditional methods in other subjects, but the Badanese method of teaching arithmetic (See Saul Badanese's Series of Child Number Books and Manual for Teachers, Macmillan Co., New York); P.S. C. employed a modified form of the activity program except in the "tool subjects," where children were grouped according to achievement test results, and the amount of drill varied with the score obtained. Pr.El. was an activity program school, but at times individual children were given drill work in fundamentals.

[22] Although progressive education can take other forms, we here confine it to those types of school activities which are commonly grouped together and characterized as constituting an activity program. We do so because "activity methods" were used in Pr.El.

uncontrolled factors. Offhand, however, it would seem from this comparison and from rough analyses of the variations of E results with teaching methods employed by individual teachers in the same school, that progressive pedagogical procedures are conducive to smaller E-Effects. This conclusion should be taken as an hypothesis which is suggested by some aspects of the results of the present study. Before any real decision can be made, more research is needed.

Chapter III

Experiments with Material Other Than Jar Problems

Section 1

Maze Experiments

In the general experiment we used a technique that was of more or less an abstract nature and involved to some degree the "higher mental processes." We therefore planned to execute experiments with other material; e.g., mazes. Such materials have some virtues: they can be tried out on younger children; they do not depend so much on school learning.

Experiment 1

The first of these experiments consisted of ten pencil-and-paper mazes of various geometric shapes (triangle, circle, trapezoid, hexagon, etc.), which were to be solved in 2½ minutes each. In the first nine the goal was reached by following an involved, circuitous pathway always to the right of the entrance (E method). The tenth could be solved in two ways, by following the twisted path to the right or by going a short distance straight up from the entrance to the goal-box (D method). Ten of 13 graduate students and 13 of 17 public school pupils used in the tenth maze—the critical task—the circuitous instead of the direct path. Immediately after each subject finished this first series, he was given seven new mazes, with the direction to trace each maze twice. These were all solvable by taking the path to the right (E method); then followed a test maze, solvable only by a path to the left. Eight of the 13 graduate students and 9 of the 17 pupils persisted in going to the right in the eighth problem and thus failed to reach the goal.

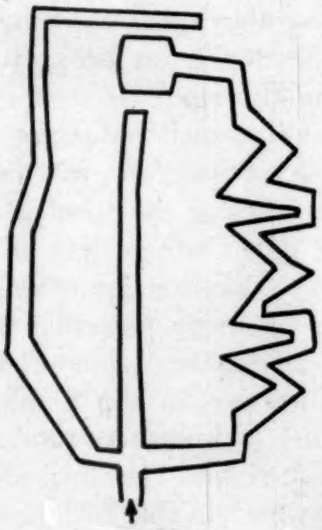
Experiment 2

In the above described mazes the subjects developed an *Einstellung* for the path to the right. Is it not possible to construct pencil-and-paper mazes in which an *Einstellung* will be developed for the figure of the open path that leads to the goal, rather than for the start-direction, the direction of the path? Such a series was made, patterned on the set-up of the general experiment. The starting path direction in the E mazes was not constant; it varied at random between left and right. The first six mazes (E mazes) were solvable by following a long, twisted path (located sometimes to the left and sometimes to the right of the entrance); in the next two mazes (critical test mazes C_1C_2) the goal could be attained by this "zig-zag" path or by taking a short, straight path upwards from the entrance to the goal box; in the ninth maze the goal was reached only through the straight path upwards but not through the circuitous one; the next two mazes (critical test mazes C_3C_4) were solvable both by the twisted path and the short, straight path.

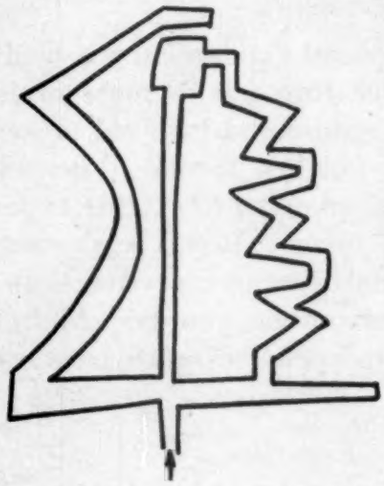
One of the E mazes and a critical test maze is shown on page 24. The others differed in their geometric shape and in the location of the "crooked" path.

The experiment was administered individually—in order to be able to obtain all the comments of the subjects—to children of 6B, 5B, 2A, and 1B classes. Half of the children served as a kind of DBB group; they were told before the experiment began, "You are going to solve some puzzles. If you are not careful, after the sixth problem you may do something

foolish. You may act like a blind man who cannot see what he is doing. Therefore, I am giving you this warning: "After you finish the sixth puzzle, say to yourself the words, 'Don't be blind.' "



E MAZE



C MAZE

The E-Effects for the 6B and 5B groups were as large as those made by similar groups in the general experiment; also the younger groups developed strong *Einstellung*. The DBB instruction did not give clearly better results.

volved pathway and continued merrily on to the next maze, not bothered by the fact (or not at all noticing) that they had actually not reached the goal-box. A few stated that the "crooked path does not work here," but did not try the D way. Reluctantly, but of their own accord, they went on to the tenth maze and solved that in the E way.

Subjects who had taken the involved path in the first two critical test mazes were asked by the experimenter, after the last maze, to indicate how they had solved the first critical. Two types of reactions were observed: The one, that of the child who again carefully traced the "zig-zag" path to the goal and anxiously inquired, "I did it this way. Don't you

TABLE 10

	Plain							DBB						
		C_1C_2		C_3C_4		#9			C_1C_2		C_3C_4		#9	
	o's	E	D	E	D	F	S	o's	E	D	E	D	F	S
$6B^1$	16	75	25	50	50	70	30	16	75	25	56	64	75	25
$6B^2$	14	86	14	64	36	79	21							
$5B^1$	11	91	9	73	27	64	36	11	90	10	56	64	60	40
$2A^1$	13	85	15	81	19	62	38	13	100	0	85	15	77	23
$1B^1$	15	83	17	80	20	67	33	15	80	20	80	20	60	40

The ninth maze was a source of trouble for most subjects. Some were more than halfway up or had entirely completed the tracing of the "zig-zag" path, before an exclamation of "oh!" or "It doesn't go!" indicated that they saw their mistake. Others followed the in-

remember?"; the other, one of chagrin and shame at not having been aware before of the easy way which he now saw. The former subjects were asked: "Do you see a shorter path to the goal?" After a minute's examination of the maze, most subjects noticed the direct path but two had to be shown it by the experimenter. The next question addressed to all was, "Why do you think you didn't see this easy way before?" Answer: "I looked for the crooked path and used it" or "I looked to see if the crooked path was connected with the goal, and then used it." Next in order of frequency, and a comment most popular in the 1B and 2A groups, was the statement that they did not use the short path because they did not see it. A few subjects offered explanations for the phenomena. They had been in too much of a hurry (but they had been given ample time), they had become too used to that crooked way, it had become natural to use the long way. Four subjects insisted that they had seen both ways, but preferred the longer one. (Two of these subjects failed to do the ninth maze, solvable only by the direct path. Did they see the direct path here but so preferred the longer method that they would rather fail to solve one maze? On this we obtained no clear information.)

SECTION 2

Hidden Word Experiments[23]

The subject was given the following groups of letters, one at a time, with the instruction that he find a hidden four or five letter word without transposing the order of the letters.

Illustrative:		MSAVRAE
1.	E_1	GZOQART
2.	E_2	BOUFLML
3.	E_3	DZEPEWR
4.	E_4	MPUALME
5.	E_5	WIORLZF
6.	E_6	BXESAUR
7.	C_1	TSINGREVR
8.	C_2	HFOURESTE
9.	#9	GNEVERZOE
10.	C_3	SOWRITNGE
11.	C_4	CBALMVEAL

The illustrative puzzle is solvable by beginning with the first letter and then using each alternate one; "mare" results. This pattern can be used in all puzzles (except the ninth), and in each case it leads to the name of an animal; in the ninth, however, it does not make for a solution: "Geeze" results. The last five groups each contains directly within it a common word; e.g., in the ninth the word is "never." Did the subjects develop an *Einstellung;* i.e., did they continue to use in succeeding problems the pattern which worked in the first six, overlooking the more direct solution?

Of three college students to whom this experiment was administered, three used the E pattern in C_1C_2 and said "geeze" for Problem Nine. Then they corrected themselves, saying "never," but two of the three solved C_3C_4 in the E manner.

The experiment was conducted with three high-school seniors, of whom only one did not develop an *Einstellung.* The other two solved C_1C_2 in the E way; one of them failed Problem Nine and solved C_3C_4 in the E way.

Six public-school pupils tested (4th to 6th grade) all used the E pattern in C_1C_2 and said "geeze" for the ninth puzzle. Four corrected themselves and gave "never." All six solved C_3C_4 in the E manner.

Of three uneducated adults, one refused to become conditioned. He gave more than one answer for each of the test problems. Another did C_1 in the E

[23] A number of similar studies have been conducted. The reader is referred, for example, to: H. V. Rees & H. C. Israel, *An Investigation of the Establishment and Operation of Mental Sets,* Psychological Monographs. Vol. 46, No. 6, (1935).

manner but recovered in C_2 and solved the subsequent tasks in the D way. Still another solved C_1C_2 in the E manner, said first "geeze" and then "never," and used the D method in C_3C_4.

As usual, the subjects, upon being shown or discovering the direct method, complained that they had become accustomed to one procedure; some said that they had been looking for animal words.

SECTION 3

Geometry Experiments

The various tasks of these experiments, such as measuring water with a given number of jars, tracing a path to a goal in a maze, and finding hidden words in pied type are divorced from real school-subject matter. However, certain educational implications will be inferred from the experiments. Therefore, it leads us to test our contentions with regard to actual schooling by conducting experiments with school subjects; e.g., mathematics, social and natural sciences, vocational, commercial, and language subjects. A beginning in this direction has already been made and is reported below.

Experiment 1

The subjects were girls from 13 to 15 years of age who were repeating the first term of high-school geometry in the summer session of 1939. The experimenter gave them a series of five problems in each of which the task was to prove an angle of one triangle equal to an angle of another triangle. Four of these problems could be solved by first proving the congruency of the two triangles[24] and stating that since the triangles are congruent, the angles are equal (since corresponding parts of congruent triangles are equal). These four problems correspond to the E problems. For a test problem, we then gave to one class of eight students an example that could be solved by proving the triangles congruent[25] or merely by stating that the angles were vertical angles and therefore equal. Every student in the class ignored the fact that the angles were equal because they were vertical angles; all first proved the triangles congruent even though they knew and had often applied the vertical angle theorem.

When this experiment was given to 10 girls who had just successfully completed the first term of geometry, 8 of them showed E-Effects.

We changed the critical task so that it could not be solved by proving the triangles congruent, but could be solved by just stating that vertical angles were equal. This set was given to 6 girls who were repeating high-school geometry and to 4 girls who had successfully completed the first semester of high-school geometry. Four of the former and 2 of the latter group failed to solve it in 2½ minutes. They protested, "You did not give us enough information to prove them congruent."

When the same critical test problem alone was given to 12 other students (all of whom were repeating geometry), they laughed and said words to this effect, "Why that's easy! Vertical angles are equal; therefore angles 1 and 2 are equal."

In discussing the results with the experimental groups we obtained the fol-

[24] In the first problem two angles and an included side of one triangle were equal to the corresponding parts of the other. In the second problem two sides and an included angle, in the third three sides, and in the fourth two angles and an included side of one triangle were equal, respectively, to the corresponding parts of the other triangle.

[25] Three sides of one triangle were equal to the corresponding sides of the other triangle.

lowing information: (1) They "just did not notice" that the two angles were vertical angles. The first thing they did was to try to prove the triangles congruent. (2) Some said that they were taught by their teachers first to put down in the proof what is "given" and on the basis of all the "given" items to try to conclude. (3) Two students complained that, after all, if something is "given" it must be used in the proof.

These experiments are preliminary in nature. They must be tried out on more students, students who excel in geometry, etc.

Chapter IV

Towards an Understanding of the E-Phenomena— Preliminary Working Hypotheses

How are we to understand the phenomena found in this investigation? What is their underlying basis? What are their determining factors? We shall here briefly and tentatively state a number of hypotheses. We shall later add new and supplementary data and experiments which may clarify the theoretical situation, and perhaps aid in determining which of these hypotheses, alone or in combination, can serve as explanatory concepts.

I. Hypothesis of a general, fundamental, mechanical tendency: *if a response (activity A) is made several times in succession to a number of similar situations, there is a strong general tendency to repeat this response again in a succeeding similar situation.* This tendency to repeat, to persevere in a habituated mode of response, is viewed as a mechanism basically characteristic of human behavior. Because of the recency and frequency of the E response to the E tasks, the subject, in our experiment, repeats the E response in the subsequent test problems. One could formulate: What is necessary for the D response, and also, what is necessary for the E response was previously learned. Because of recency the latter response prevails. The set-up we have used is somewhat more specific. It is of the character of an *Einstellung* experiment in which a habit does not act simply because of some previous experience at some previous time, but a perseverative tendency is actually established in the very experimental situation, as in the case of the motor experiments of Schumann, et al.[26]

II. *To repeat blindly a response is not a feature generally or fundamentally characteristic of human behavior.* Subjects may act in this manner because they have fallen into a mechanized state of mind, because they have been narrowed down, have lost the possibility of a free, genuine view of the task. Otherwise, they would have freely faced each problem and found the direct solution. *The blind, repetitive activity is not the result of a general, fundamental tendency but is created by special factors in the situation.* Thus, to understand the E-Effect we would have to study the characteristics of situations in which it comes about.

III. The E-Effects are not brought about by mechanization but result from intelligent assumptions, from a kind of reasonable behavior.

A. Going through the successive E tasks the subject assumes, through a kind of induction, that the E method, having proven apt to solve the previous problems, will fit the following tasks also.[27]

B. Or, the subject thinks, "It is very improbable that merely by chance all these problems (the E tasks) are solvable by the same method. There will be some reason for the sameness of the method of solution. This is not a chance distribu-

[26] G. E. Muller and F. Schumann, *Uber die Psychologichen Grundlagen der Vergleichung Gehobener Gewichter,* Pflugers Archives. Band 45 (1898).

[27] Theoretically, it is questionable whether one is allowed to differentiate between such an induction and the behavior described in hypothesis I. (See page 67; pages 87-89.)

tion of problems, but rather, problems of one type, all solvable by the same method. Therefore, the method I used before will be proper for the subsequent problems too."

C. It may be that the subject reasoned in the following fashion: "As I want to get the solution quickly, I shall not waste time by considering how to deal appropriately with each problem. As a matter of expediency, I shall simply try what worked before. That may be the quickest way."

D. The subject may have assumed that the instructions given by the experimenter demanded certain reactions from him. He may have interpreted what the experimenter wanted from him in terms of the first E task, the answer to which was illustrated; and since the same method works again and again, "it is clear that the experimenter wishes that I use just this method,"—the assumption borne out in subsequent E tasks or made within them. Or similarly, he may have thought that one has to use all three jars in obtaining the answer, that one has to start with the largest jar, etc. Or, the subject may have assumed with regard to the D method that certainly no such obvious method of solution could be expected or desired by the teacher in this "contest."

IV. In hypothesis II the point is made, emphasized by Gestalt psychologists, that in trying to understand responses we must take into account characteristic structural features of the whole situation. We shall note later several other points of this kind (hypothesis V below). First, we shall formulate a comparatively simple thesis with regard to the set-up of the tasks.

The E response to a test problem may come about only if it is viewed as one equal member of a unitary group. If it would not appear as a member of a homogeneous group, but say, for example, by structural separation could be made to appear as belonging to another, new, starting group, the tendency to react in the E manner would decrease or disappear. It would be then not essential that the test problem immediately follow the E tasks, but that it appear, through the specific conditions of the experiment, as an equal part of a whole which is one unitary group, unitary also with regard to the applicability of the E method. As the tasks, so the responses build in such cases a quasi-rhythmical succession of parts in one underlying whole.

There are theoretically two opposing gestalt factors involved in the phenomena here studied, one making for E and the other for D solutions. The one mentioned above, which works so that the test problem appears and is accepted as part of the unitary set-up, favors E responses; the other, the structural requirements of the test problems (this is especially clear in the C′ tasks); work in this separated subwhole (the test problem) for D solution. The second tendency is less external and superficial than the first, as realization of the structural features in the problem takes place. This awareness of the structural conditions of the test problems operates against taking this task as a member of the unitary set and separates it from the E problems.[28]

[28] In terms of traditional Association theory, one could describe what happened in our experiment in these terms: Sometimes in the past the subject became habituated to the D response; in the E problems he becomes habituated to the E response. The criticals involve conditions in which the two tendencies vie with each other, and in E-Effects, on the basis of recency, the E habit wins out.—Mechanization and induction can both be reduced to these terms.

Such a description clearly does not seem to give the whole picture of what occurred in certain cases. Processes differing from such a "mecha-

V. If we are to comprehend features of the whole situation, points of still another kind must be taken into consideration.

A. Let us mention here one of these matters, the factor of confidence. Since it appears in the E tasks that the experimenter is interested in and wants E performances, and since the experimenter is a friendly-looking chap, apparently without any tricky intentions, there is no need for being wary or suspicious. The subject does not suspect that the experimenter will deceive him by giving problems that look like the others but have a different and better method of solution. If in each problem these subjects would watch out, would suspect some "catch," no E-Effect would be shown. There is a kind of confidence, of innocent reliance, which leads to E responses because the subject does not at all expect that he will be tricked.[29]

B. There may have been subjects who, even if voluntarily serving as subjects in the experiment, look at the problems put before them with some contempt. They fail to notice anything particularly interesting in the E tasks, are bored, dislike being bothered by such "childish work," lose whatever interest they may have had at the start, and develop a superficial manner of dealing with the subsequent problems, merely repeating the same method in all, without even troubling to really look at the problems.

C. The subject feels himself in the role of a pupil who is not asked to face problems freely but is expected to perform what the teacher taught him. The relationship between teacher and child, between the pupil and assigned tasks, demanded performances, and demanded personal attitudes—in a way created by school situations and other such situations—determine his response. The subject may carry over the habituated attitude to the experiment. He may not have often experienced in such situations another possible kind of attitude—such as freely facing the requirements of the situation—or he may have lost it through certain drill procedures, etc., in school or in other life situations.

In this way factors of personal attitudes and of social atmosphere may play a decisive role.

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nized state of affairs" seemed sometimes to be operating also in the very E responses.

In line with Gestalt theory we could say: There are two extreme possibilities in handling a problem situation: (a) trying to face structurally the actual situation, dealing intelligently with it according to its structural requiredness, or (b) acting on the basis of the "unity of the group," more or less blindly carrying over, repeating what one did just before, instead of thinking. (from a lecture delivered in 1937 by Professor Max Wertheimer in The Psychology Seminar at the Graduate Faculty of Political and Social Science, New School for Social Research, New York City).

[29] This does not imply, by any necessity, that the most adequate attitude with which to meet the test problems is suspicion. Just the opposite seems to be the case. To view freely, to look directly at the merits of the problem situation, not negatively suspicious, but facing positively the actual requirements of the problem—these appear, to us, to be important (see par. 3 of page 33). Of course, if one is inclined toward blind mechanization, the suspicion of some trick may aid him, but the more favorable conditions seem to be not to be concerned with trickery but to go straight and productively forward with each task.

Chapter V

Non-Einstellung Behavior

Before proceeding with the reports of what may be called "experimental variations," it is necessary to state that in nearly every group to which we gave the experiment (with the exception of only few classes) there were subjects who solved the test problems in the D manner. True, they were often the small minority, but they must be considered. Perhaps we would know more about the proper explanation for the results if we would find out why these subjects did not manifest Einstellung behavior whereas the others did.

One may assume, in accordance with hypothesis I, that these subjects did have an Einstellung but, at the crucial moment, when the test problems were given, they were saved by some additional factor. It may be that all individuals develop Einstellung but that some are able to overcome it when the test problems are presented. It is important, therefore, to know whether or not the subject who gave D responses had no E tendency at all, or had been able to overcome it at the given time.

(1) In some cases it is clear that the subjects did show an E tendency—they began to solve C_1 in the E manner but crossed out their work and gave a D solution.[30]

(2) In others, only a D solution was given to the critical, but the subject added a comment which indicated an expectation of an E response. "I am not a fool"; "I am not that dumb"; "Trying to catch me?"; "There are two ways of doing these problems"; "This was made for the gullible ones."

(3) But in a few cases there appeared to be not the slightest tendency to use or to think of the E method. When we showed them the E solution, they appeared sincerely surprised that the problem could be solved in a way other than by the D method. The D method seemed to them to be the "natural way" of solving the problem.

We do not know how many of the subjects who gave D solutions fit into each of the above-named categories. But this much is clear: there were some subjects who seemed to have no E tendency whatsoever.

Why is it that some individuals, unlike most of our subjects, did not develop an Einstellung or, if they did develop one, were able to overcome it before any of the test problems were presented? One could at first simply ask whether they showed no Einstellung tendency because of their superior intelligence. In order to answer this question, below we present the I.Q.'s of the public school subjects[31] in the Plain group who used the D method in all the test problems, and of the pupils in the Plain group who used the E method in one or more test problems.

With regard to the median and Q_1, both groups are quite similar, the 52 subjects who had no E-Effect showing a

[30] In the actual tabulation of results these were included in the D responses.

[31] I.Q.'s were available only for the public school pupils and not for the adult, college, or high school subjects. Consequently, our treatment of the relation of I.Q. to Einstellung is necessarily limited. We include in the above discussion only those pupils who solved all the E problems.

small superiority; a comparison of the values of Q_3 indicates that the latter subjects had a greater percentage of higher I.Q.'s than the group that showed E-Effects.

There were a considerable number of subjects whose I.Q.'s were definitely not superior and yet who did not show the Einstellung tendency: 25 per cent (Q_1) of the 52 subjects had I.Q.'s below 92, and 50 per cent (median) had I.Q.'s below 104. If we suppose that possessing a high I.Q. saves one from developing an Einstellung, what saved these subjects? Of course, it could be argued that the subjects with low I.Q.'s did not show E-Effects because they were not clever enough to realize the possibility of repeating the E method in the criticals. This would lead us to expect that already in the E tasks they had difficulty in repeating the E solution. But this was not generally the case for the subjects here in question.

The matter of I.Q. is not settled to our satisfaction. More research on the problem and a more refined statistical treatment might help clarify the issue, but at the present time we are not in a position to make any conclusive decision as to the role played by I.Q. (Also see pages 18-20.)

We have considered here the possibility of employing the concept of I.Q. as an explanation for no E-Effect. The same question could be raised for other individual differences, such as age and the amount of education. Our results seem to show no consistent variation of age and E-Effect, or educational level and E-Effect. We had very young and very old subjects who did not show E-Effect, and some younger groups contributed more such subjects than did some older groups, and vice versa. A similar statement could be made concerning the educational level. Again, the factor of age, by itself, or of the educational level, by itself, does not appear to be the decisive explanation. (Also see page 18.)

TABLE 11

	O's	Range of I.Q.'s	Median I.Q.	Q_1	Q_3
Showed no Einstellung	52	75–155	104	92	128
Showed Einstellung	377	51–160	101	90	112

In a number of experiments administered to both individuals and groups, hints of a possible explanation of why some show E-Effect and others do not become apparent.

1. Subjects said that they repeated the E method in all the problems because: All the problems were the same; they learned or caught on to the trick or rule; they did not think of other methods because the same methods always worked; they were practicing a rule; they stopped thinking—it gave the correct answer; it was quicker and easier than to stop to look for new methods; it became natural, automatic.

2. Some subjects, few in number, worked slowly, examined each problem carefully, and only then gave an answer. Already in the E problems (E_4) they found another solution, $A+2C$. They reported that they tackled each problem anew, and it was clear from their remarks that they did not at all think of rules or of repeating the E method. In some examples they saw, after careful examination, that the E method should be used again; in others the D solution

was obvious to them.

3. In some of our individual experiments with bright children between the ages of 10 and 14, who did not show any E-Effect, a direct reason became clear. Already in performing the E tasks they did not show any mechanization. They refused to become conditioned. They looked at each of the tasks anew, trying to find the proper way to deal with it. So little did they think of merely repeating what they had done before that they had sometimes to be reminded, "Why don't you use the method you used before?" This seemed to them clearly not the way they liked to do things. They were not suspicious. Their attitude basically was one of directly looking at the problem at hand in order to discover the proper way of solving it. These children were in no danger of falling victim to the Einstellung.

4. The other extreme of this attitude was revealed by subjects in individual experiments who persisted in the E manner even when the following procedure was employed. After the E set a critical was presented. If the response to it was in the E way, it was followed by an extinction task of the type of Problem Nine, and then by another critical. If this also was solved by the E method, increasing numbers of extinction tasks (2, 3, and 4) were interspersed between the criticals. Some subjects persevered in the E method even after a set of four extinction tasks. They simply did not realize that there was a possibility of solving a critical by the D method, even though some of them used this method in the interspersed extinction problems. Of those who recovered from the Einstellung, a few started to persevere in the D manner, attempting to use it even when an E problem was again given. They had substituted one habit for another. It was very difficult to get them to deal properly with the problems; they were not able to throw off the yoke of habit.

Conclusion. In some of our subjects there appeared to be no tendency to use the E method. This throws doubt on the validity of hypothesis I. Furthermore, it seemed that a difference in attitude and approach to the problems might explain why some developed an Einstellung and others did not. This speaks against hypothesis I and favors hypotheses II and V.

Chapter VI

Survey of the Main Points in Experimental Variations

Variations of the experimental situation in the following preliminary experiments showed that whether or not E-Effects resulted depended on features in the situation and on the subjects' attitudes; there were cases in which, in spite of a number of E problems, no E-Effects were found; and, on the other hand, cases in which the use of only one E task resulted in positive E-Effects.

We shall in a few words describe the variations introduced in the preliminary experiments and shall briefly characterize the results.[32]

1. Increasing the number of E tasks above five increased the E-Effect[33] in the tested groups.

2. A) Decreasing the number of E tasks to two brought in some of the tested groups a decrease in E-Effect in C_3C_4 and Problem Nine, but not in C_1C_2. In some experiments even one E task generated E-Effects. (See par. 11, page 35.)

B) The interspersing, within the E set, of tasks not solvable by the E method but by the more direct (D) methods made for a marked decline in E-Effects in the tested groups.

3. Increasing the number of extinction tasks (i.e., presenting more than one problem of the type of Problem Nine between C_1C_2 and C_3C_4) decreased the E-Effect in one public school and all of the tested college classes, but did not decrease it in some other public school classes.

4. A) Separating the test tasks from the E tasks by a time interval of 1 day, 3 days, 1 week, or 1 month decreased the E-Effect. An interval of 1 hour did not clearly decrease the E-Effect in the tested classes. In no instance did the E-Effect in the tested groups completely disappear; even after an interval of one month there was still 27 per cent E solutions. Crucial seemed to be whether the subjects thought that the later given critical set was a continuation of the previous tasks or not.

B) When, in addition to a time interval, we remarked at the second set that a new experiment was commencing, the E-Effect decreased.

C) Instead of using a time interval as a means of separating the E from the test tasks, we directly told the subjects that the E problems were characterized by one procedure and the test problems by another. This brought in the tested college classes a decline in E-Effects, not in the tested public school classes. It was clear in the experiment that the efficacy of the procedure was dependent on how seriously the experimenter's remarks were taken.

5. Introducing speed, by decreasing the time allotted per problem or by asking for speedy responses, increased the E-Effect. It led to 100 per cent E-Effect in a group which 3 months before had shown 60 per cent; and E-Effect, as large as in similar groups of the general experiment, in another group which previously had received clarification about

[32] A report of each experimental variation is presented in the following chapter. This survey does not describe all the experiments contained therein.

[33] Here, as in all formulations of this section, the term E-Effect refers to the E reactions in C_1C_2, C_3C_4, and to failures of Problem Nine.

the experimental set-up (see par. 13, p. 00).

6. Introducing procedures intended to decrease speed attitudes; e.g., by allotting more time per problem, by instructing the subjects not to hurry, did not change the E-Effect in the tested public school groups, reduced it somewhat in the college groups. When the non-speed instruction was given just before the criticals, the E-Effect decreased somewhat more in the college classes. When such non-speed instruction was connected with the direction to take more time in order to find more direct and sensible answers, the E-Effect showed a strong decrease in the tested college classes.

7. Since in the E problems the position of the jar numbers as to their use in the B—A—2C method was constant, and the E-Effect might therefore be strongly connected with a positional set, we conducted experiments in which we changed the position of the jars in every problem or only in the test problems. In some of the tested college classes, the E-Effect decreased somewhat (in C_3C_4 and Problem Nine), not in the tested public school classes.

8. As there was the possibility that subjects interpreted the demands of the experiment in a specific manner, assuming, for example, that one had to use all three jars, we introduced the following variation. We said with every task or only with the test problems, "Using one, two, or three of these jars, how would you obtain —— quarts of water?" The tested college groups and some of the tested public school groups showed somewhat smaller E-Effects (but not in C_1C_2); the other tested public school groups did not show a decrease.

9. Similarly, the subjects may not have thought of employing the D method because of being focused by the E set on using the largest jar. When several groups were given this specific instruction with every problem: "You do not have to use the largest jar," the E-Effect decreased in the tested college group, not in the tested public school class. When the additional instruction was given only with the test problems and not before with the E tasks, the E-Effect weakened considerably in both the public school and college classes.

10. A) Before the E problems, we gave in one public school class a set of jars in which, after the solution for one goal was found, other goals for the same set of jars had to be reached, including goals in which a D method was used. The E-Effect was not decreased in the tested group as compared with the general experiment.

B) We gave another public school class, before the E set, three ambiguous problems in each of which several ways of solution were to be found, presenting illustrations. Again there was in the tested group no change in the E-Effect.

C) When with each problem of the general experiment or only with the test problems, the instruction was issued to find as many different methods of solution per problem as possible, some groups showed decreases in E-Effect, although many subjects varied mainly the E method externally, as, for example, changing B—A—2C into B—C—A—C, etc. These results were not greatly altered even when among the criticals were problems of the character of C′ tasks (see par. 12A, page 36) which allowed a more direct solution by the filling of just one jar.

11. As we had noticed in some individual cases that even one E task might produce E-Effects in subsequent criticals, and since in remarks of the subjects it appeared clear that this result was brought about because they assumed that

the E method in the first task gave the rule for the following tasks, we introduced this factor explicitly in variations.

A) While working on the E tasks, the subjects were asked to find the general rule governing the problems. In the tested groups this procedure made for E-Effects larger than those made by similar groups in the general experiment.

B) In other experiments, we said, when the first E task was presented and its method of solution illustrated, "This is the rule for this kind of problem." The tested classes had 100 per cent or nearly 100 per cent E-Effect.

C) When the rule was given or generalized, and only one E problem presented, the E-Effect in a number of public school classes was greater than or equal to what resulted in the general experiment with five E problems.

12. A) A critical test problem solvable by the E method and by an extreme direct method—the required amount of water obtainable by just filling one of the given jars—was presented after the E problems. In the tested groups, E-Effects in this C′ problem and in the subsequent usual criticals were about as large as in comparable groups of the general experiment.

B) Even when a problem solvable by the extreme direct method but not by the E method was presented after the E problems or in place of the usual Problem Nine, the tested public school and college classes showed rather large E-Effects in the new problem and the subsequent usual criticals.

13. A) In trying to get at the opposite extreme of the usual results of the general experiment, we gave before the experiment a clarification of the ambiguous nature of the test problems, illustrating in a critical task how people may be misled on the basis of mechanically carrying over a response, may be blinded to a more direct way. When the general experiment was then administered, E-Effects declined sharply in many cases; not in all cases. When the general experiment was given with a "speed introduction" or with an increased number of E tasks, large E-Effects were found again, sometimes as great as in the general experiment.

B) Still stronger decreases of E-Effect, often to zero, were obtained when the following procedure was employed: first, the general experiment was administered, the usual E-Effect resulting; a discussion followed in which the subjects were led to see both possibilities, the E and the D method, in a critical; then the entire experiment was re-administered. The second time there was no E-Effect—all of the tested groups showed 100 per cent D solutions.[34]

The results were similar when not the same set of problems was repeated but problems differing in the jar numbers, similar only in nature, were given after the discussion.

When after the clarification there elapsed a time interval; e.g., one month, there appeared some E-Effect (10 per cent) in the second presentation of the general experiment.

If in the second administration of the experiment, speed conditions were introduced or the number of E problems increased, large E-Effects appeared again, for some individuals as great as in the usual experiment.

14. A) That in the general experiment the E method of solution was illustrated in the first E task by the experimenter—and not the D method—may have been of importance; e.g., by focusing the sub-

[34] Repeating the general experiment after a time interval, without the intervening discussion, did not significantly reduce the E-Effect.

ject on the E procedure, by facilitating certain assumptions about the experiment (cf. hypothesis III, page 29), or through the possible prestige of the experimenter and assumptions about his wishes. Therefore, we conducted a number of experiments in which the E method was not illustrated by the experimenter. In the groups we used, this procedure seemed not to reduce the E-Effect; it was about as large as usual.

B) To test the prestige factor, experimenters were employed who, as far as could be ascertained, held no positive prestige for the group or were disliked by the group. So far, this brought no decrease of the E-Effect.

15. It seemed probable on the basis of our impressions in the experiments that creation of two different kinds of atmospheres would bring strong opposite results. If there was an atmosphere of slavishness,—of fearfulness,—a "test atmosphere," this seemed to work strongly in the direction of increasing E-Effects; if, on the other hand, the subjects felt free, not subject to any influences of this kind, this seemed to work against the E-Effects. Some results speak in this direction (see par. 3 of page 30), and this may also have been a decisive factor in the smaller E-Effects and better recovery in the progressive school (see page 13), but this question will have to be studied more directly.

16. In order to rule out a number of factors mentioned, we made experiments of the following kind with some groups. The set was not simply given by the experimenter; instead the experimenter showed only one jar problem—in manipulating two jars a certain amount was reached—then the class was asked to formulate, at home, problems with sets of three jars and to write them on a piece of paper with the goal to be reached. In the next session of the class the papers were collected; then apparently reading out of them, the experimenter gave the problems of the general set. If only one E was given, followed by the criticals, there was no E-Effect, with the exception of one subject; if, as in the general experiment, the five E tasks were used, there resulted again E-Effects of a size as in the general experiment.

CHAPTER VII

REPORTS OF THE EXPERIMENTAL VARIATIONS

IN THIS chapter are reported the experimental variations, some of which already have been briefly described in the Survey (pp. 34-37). The primary purpose of conducting these variations was to bring about experimentally the extremes in E-Effects, that is, 100 per cent E-Effect on the one hand and 0 per cent on the other. In attempting to accomplish this, we often introduced in an experiment more than one change in the usual set-up, with the hope that the cumulative effects of the changes would produce the desired results.

The succession of sections in this chapter follows that of the Survey, except where otherwise stated.

SECTION 1

More E Problems

Experiment 1[35]

When to three classes of sixth year public school pupils ten E tasks were presented before the test problems (see page 94 for the E problems), the E-Effect did increase. Every subject used the E method in C_1C_2 and almost every subject failed to solve Problem Nine. Of course, in the general experiment there were a few public school classes that gave 100 per cent E of C_1C_2 and nearly 100 per cent failure of Problem Nine but these were very few in number. Here, in every case, there was 100 per cent E of C_1C_2 and almost 100 per cent E of C_3C_4 and 100 per cent failure.

TABLE 12

	O's	C_1C_2	C_3C_4	#9
		E*	E	F
$6B^1$	31	100	97	97
$6B^2$	42	100	100	100
$6B^3$	39	100	100	100

* In order to shorten the reports of these preliminary experiments, we focus on the question of whether the response was E or D in the criticals, D or F in Problem Nine: A response which showed clearly that the E method was used, was counted as E (even if, as sometimes happened, an error in computation was involved); similarly with a D response. The very rare cases which did not clearly fit these categories of E or D, D or F, were omitted from the results. In this way, E and D in the criticals, D and F in Problem Nine, add up in each case to 100 per cent. This permits a simplification of the tables. We shall present in this and in the subsequent tables only the per cents of E responses in the criticals and the per cents failures in Problem Nine. To obtain the per cents of D responses in the criticals and in Problem Nine one need only subtract the given figures from 100 per cent.

Experiment 2

We have conducted a number of preliminary individual investigations with college students, using 10, 15, 20, 25, and 30 E problems. Since the cases are too

[35] In this and in the subsequent preliminary experiments, as in the general experiment (see page 10), for the sake of simplicity we used in computing the results only those subjects who had successfully solved the last two E problems in the E way.

We shall frequently compare the responses of the groups who took part in the following changed experimental situations with those made in the general experiment by groups of similar age, I.Q., and educational level. Comparison with the general experiment is often not simple because the range of its results were considerable. We shall limit ourselves, therefore, to statement of the following kind: If the changed experimental set-up brings about a very clear change in the results as compared with the range of the general experiment, that is, if the E-Effect decreases or increases considerably, we shall speak of a decrease or increase in E-Effect as compared with the general experiment. In cases in which the change is not so marked, though indicated, we shall confine ourselves to the statement that the results lie about within the range of the results of the general experiment. Only differences of an outstanding kind are what interest us here in these preliminary experiments.

few to be of any quantitative significance, we shall here report on the general trend of the results.

1. A few subjects soon tired of repeating the E method and refused to continue with such "insane" tasks.

2. Others also became bored by the repetition but, after protesting, said that they were going to find a sensible way, or at least another way of solving the problems. In one of three of such cases, the D method was discovered as soon as C_1 was presented. The subject exclaimed, "Thank the Lord. At last I don't have to repeat. I think I see the point of the experiment—I was supposed to become mechanized."

3. Others thought that they were being tested on their ability to solve easy tasks quickly. In such cases we had a speed test—the subjects trying to solve each problem in less time than the previous one—and, of course, Einstellung Effect.

4. A few suspected a trick of some sort and stopped every now and then to say, "Well, where is the catch?" But by the time the criticals were given, their cautiousness had ceased, and they gave E solutions.

5. Some subjects obediently repeated the E method in each problem, saying nothing, but working carefully and diligently at the tasks.

6. Of the score of college subjects studied we came across only one who slowly and painstakingly dealt with each problem, at times trying new approaches in the E problems (which failed). When he came to C_1 he used the D method immediately. Later he said that he tried to do each problem as sensibly as possible and not just repeat what he had done before.

It would be of interest to see what occurs if E tasks are given to a subject until he refuses to do any more. When C_1 is then presented, will the D method be used?

Conclusion. Increasing the E problems increased the E-Effect. The preliminary experiments indicate that the attitude of the subject to the problems was influential in determining the development and strength of the resulting Einstellung.

SECTION 2

A. Fewer E Tasks

Experiment 1

Before the test problems only E_1 and E_2 were given. Although these classes had but two E problems, the amounts of E solutions of C_1C_2 in the Plain groups were as great as those made by similar groups in the general experiment. In the public school Plain groups the per cent failure of Problem Nine was as large as usual; but the failures decreased in the adult and college Plain and DBB groups.

TABLE 13

	Plain				DBB			
	O's	C_1C_2 E	C_3C_4 E	#9 F	O's	C_1C_2 E	C_3C_4 E	#9 F
Coll.	15	77	61	0	15	70	37	0
Coll.	18	72	31	6	18	47	9	0
Adult	27	75	63	37	32	64	10	9
P.S.	23	80	60	61				
P.S.	25	64	60	52				

Experiment 2

Will there be no E-Effect if only one E task is used? In one 6B class of 29 pupils we gave the test problems after only E_1 had been presented, and yet the E-Effect was similar to that of some equivalent groups of the general experiment: 64 per cent E of C_1C_2, 59 per cent E of C_3C_4, 44 per cent failure of Problem Nine.

Discussion after the experiment brought out that some children thought they were to practise in all the problems a rule or formula illustrated in E_1. (Cf. Experiment 1 on page 38.) Others said that they used the E method because they had not been told to seek other methods or because that was the method first used.

Experiment 3

Perhaps there would not be E solutions of the test problems if the subjects were given three different problems,[36] none solvable by the E method before the one E task. (Cf. pages 63-64.) Since four methods were used before the test problems, there would be less likelihood of the subject developing a tendency to use just one of these methods, the E procedure, and certainly less chance for him to believe that it was the E method which applied to all these problems. If he inferred anything from the first four, it should have been that each problem had another method of solution. But, in a $6B^1$ class of 35 pupils (termed by the principal the "brightest class in the school") there resulted:

C_1C_2: 61% E C_3C_4: 60% E #9: 43% F.

After the experiment a number of subjects reported that from the beginning they had been seeking a rule or procedure to solve these problems. The first three problems offered them some difficulties, but after E_1, matters were simplified because one method worked in all problems (or in all but one: Problem Nine). These children, like many subjects of Experiment 2, regarded the problems as necessarily solvable by the same method, and they evinced a strong desire to find *the* method. Again we see in public school subjects this search for one procedure for a series of problems. The three differing problems were not sufficient to destroy this attitude.

Experiment 4

Individual experiments corroborate the above results. One E problem produced E-Effects when the subject was striving to find a procedure to solve all of the problems. When the subject had no such desire, when he was not hurrying to finish quickly, when he did not believe that he was practising a method which solved a certain type of problem, when he carefully examined each problem trying to find various solutions, there appeared to be less tendency to use the E method in the criticals or Problem Nine.

Described elsewhere in this paper are the "The E Method as a Rule and Only One E Problem" and the "Alternating E and Non-E Tasks" variations, in which a test problem was preceded by only one or two E problems. The E-Effects found in these experiments were smaller than those which resulted from the above described procedures.

Conclusions. From the above experiments we cannot conclude that reducing the number of E problems will, ipso

[36] 1. 150 25 get 100 (no E method, no D method)
2. 36 4 8 get 24 (no E method, D method)
3. 29 3 get 20 (no E method, no D method)

facto, reduce the E-Effect. In some cases it did reduce it; in many cases it did not. Decisive seems to be the attitude of the subject toward the problems.

B. Alternating E and Non-E Tasks

Will the E-Effects decrease if E tasks are alternated with problems not solvable by the E method but solvable by the $A + C$ or $A - C$ methods (problems similar to Problem Nine)? The experiment was conducted in the usual fashion through E_1. The subsequent problems given, in the order of their presentation, were E_3, $A - C$ problem, E_4 $A + C$ problem, E_5, C_1, C_2, #9. In four 6B classes the E solutions of C_1C_2 ranged from 10 to 21 per cent, and failures of Problem Nine from 6 to 19 per cent, indicative of a considerable decrease in E-Effect, as compared to the general experiment and even as compared to public school groups given only two E problems (see page 39).

Moreover, as a last problem the classes were given 10, 96, 4, get 58, not solvable by the E method but by $B - 2C - 3A$ (E′ Method) and by $5A + 2C$ (other method). This problem, when given to three 6B classes after the general experiment, had not been solved by even one subject. Here there were many subjects in each class who solved the problem, solutions ranging from 61 to 94 per cent in the four classes.

By alternating problems solvable by three methods ($B - A - 2C$, $A - C$, $A + C$), this procedure violated an accepted rule of pedagogy—in the initial learning period, isolated drill should be used; you can teach only one thing at a time. Many of our subjects, however, were not only able to use all three methods, each when necessary, but were also able to cope with a problem requiring a method other than the three just practiced.

C. Presenting Problem Nine Earlier in the Experiment

Experiment 1

If Problem Nine is presented earlier in the experimental set-up, and the subjects allowed an opportunity to see the difficulties which repetition of the E method leads to, will the E-Effect decrease? In a 6B class of 37 subjects Problem Nine was given immediately after E_2. One minute after its presentation we asked those who solved it to write why they thought the others had failed; those who did not solve it were given 28, 3, get 25 quarts of water, and then told to return to Problem Nine, and if they were successful now, to write why they had previously been unable to do it. We then continued with $E_3E_4E_5C_1C_2$. The E-Effect on C_1C_2 was as large as in some sixth year groups of the general experiment (68 per cent E). The pupils' comments were:

TABLE 14

		E_3	A−C	E_4	A+C	E_5	C_1C_2	#9	New Problem		
Class	O's	E	F	E	F	E	E	F	E′	Other	F
6B	33	97	24	90	15	94	21	18	61	0	39
6B	30	87	10	90	10	87	10	19	49	19	42
6B	30	93	20	90	13	93	10	6	64	30	6
6B	31	90	10	97	16	94	21	18	78	13	9

"It became easy"; "I found the trick"; "—the rule"; "One method always worked."

Experiment 2

Perhaps the subject tried to use in E_3 the $A - C$ method which he had learned in Problem Nine but, since it did not apply, had to use the E solution. The same thing might have happened in E_4 and E_5, so that by the time he came to C_1C_2 he no longer bothered to look for D solutions. But then he should not show E-Effects if between the E problems criticals were interspersed: $E_3C_3E_4C_4E_5$-C_1C_2. This was done in two public school classes. They showed markedly less E-Effects than most groups of the general experiment—only 16 and 17 per cent E of C_1C_2.

Contained in the following table are the per cents E solutions or failures of each problem presented in the experiment. The last column (C_1C_2) is the one with which we are now mainly concerned.

TABLE 15

Class	O's	E_1	E_2	#9	E_3	C_3	E_4	C_4	E_5	C_1C_2
		E	E	F	E	E	E	E	E	E
$5B^4$	32	75	50	6	44	25	81	12	88	16
$5B^3$	30	47	93	27	73	13	93	53	93	17

Summary. So strong was the tendency to develop an Einstellung that it could not be destroyed by presenting Problem Nine sooner and allowing the subjects to realize why they had failed to solve it. Only by interspersing, between the subsequent E problems, tasks in which a direct method could be used, did we obtain decreased E-Effects.

SECTION 3

More Extinction Tasks

Would Extinction Effects increase if a greater number of extinction tasks were given? Below are described several experiments in which three extinction tasks were presented after C_1C_2 and before C_3C_4. In order to ascertain whether the subject had merely substituted the method of the extinction tasks for the E method, or whether the extinction problems had made him face problems directly, we added after C_4, a C′ problem (3, 64, 29, get 3), solvable by filling one jar or by the E method. Except for the increase in the number of problems, the set-up and the method of administration was that of the general experiment.

Experiment 1

The three extinction problems used were all solvable by the $A - C$ method (28, 76, 3, get 25 (Problem Nine); 39, 93, 4, get 35; 29, 52 9, get 20). A 5B class and a class of college juniors served as subjects. [Four college students claimed that they used the D method beginning

TABLE 16

	O's	C_1C_2		Extinction Tasks						C_3C_4		C′	
		E	D	F	S	F	S	F	S	E	D	E	D
P.S.	33	91	9	76	24	76	24	76	24	86	14	85	15
Coll.	28	57	43	36	64	21	79	21	79	30	70	39	61

with C_1 because they then discerned a sudden change in the experimenter's voice and interpreted it to mean that a new kind of problem would follow. (Cf. hypothesis III)]

The Extinction Effect in the public school class (5 per cent) is similar to that obtained by the use of Problem Nine only, but in the college class the effect (27 per cent) is somewhat better than in equivalent groups of the general experiment. Comparison of public school with college results is made difficult by the large difference in initial E-Effect and by the children's smaller per cent solutions of the extinction problems. Some reason for the large per cent failures of solutions in the public schools and for the apparent ineffectiveness of the extinction tasks in bringing about D solutions of C_3C_4 and C′, is revealed when we learn that 23 of the 33 pupils wrote that they thought they were practising a rule or a method, many adding that all the examples were subtraction examples. The comparatively large per cents D solutions of C_3C_4 and C′ in the college classes, and the comments of the subjects, serve to show that recovery was quite good in this group, and that it was, by and large, not mere substitution of an $A - C$ for a $B - A - 2C$ habit, but genuine recovery, a realization of the possible danger of applying an oft-repeated method. Still, 39 per cent of the college students solved C′ in the E manner.

TABLE 17

	O's	C_1C_2		Extinction Tasks						C_3C_4		C′	
		E	D	F	S	F	S	F	S	E	D	E	D
P.S.	31	83	17	58	42	55	45	38	62	48	52	44	46
Coll.	28	83	17	33	67	26	74	26	74	28	72	30	70

Experiment 2

Since many of the pupils of Experiment 1 had been hindered by their belief that these were subtraction examples, we took steps to obviate such assumptions by giving three extinction problem of an $A + C$ character (28, 63, 2, get 30; 11, 59, 4, get 15; 22, 77, 3, get 25). This set-up was administered to a 6B class and a college junior-senior class.

Now the public school as well as the college class has more recovery than similar groups of the general experiment: 35 per cent and 55 per cent for the public school and college classes, respectively. For the first time an elementary school class shows a clear-cut recovery effect, even giving a substantial per cent D solution in C′. It is interesting to note that in this class only 8 of the 31 children wrote that they thought they were practising a rule—each of the 8 gave 0 per cent D in every critical and extinction problem.

Experiment 3

In another variation we presented both $A - C$ and $A + C$ extinction tasks: 11, 59, 4, get 15 ($A + C$); 28, 76, 3, get 25 ($A - C$, #9); 28, 63, 2, get 30 ($A + C$). A college junior group which participated in this experiment showed large recovery effects as shown in Table 18.

But a 6A class of 15 subjects showed a very poor Extinction Effect. Examination of the answers they gave to the questions posed after the experiment showed that all but 3 subjects claimed they were practising a rule, that these were subtraction examples, that all could be done in the same way. Two of

TABLE 18

	O's	C_1C_2		Extinction Tasks						C_3C_4		C′	
		E	D	F	S	F	S	F	S	E	D	E	D
Coll.	25	80	20	72	28	40	60	44	56	32	68	32	68

the 3 showed D solutions in each of the criticals and extinction tasks; one showed all E solutions. The other 12 subjects gave the results shown in Table 19.

TABLE 19

	O's	E	D	F	S	F	S	F	S	E	D	E	D
P.S.	12	83	17	100	0	75	25	100	0	79	21	92	8

Not evident in the table is the fact that they had 0 per cent D in C_2, which is solvable by an $A + C$ solution.

This group illustrates the importance of the attitude of the subject to the tasks. Extinction problems, in and of themselves, cannot produce D solutions so long as the subject is centered on repeating or practising a rule. This brings to mind the behavior of those subjects who failed to recover even after a total of eleven extinction tasks, among which the same critical was interspersed four times (see par. 4 of page 33 for this experiment).

Experiment 4

From the foregoing experiments it seems that $A + C$ extinction problems were more effective in producing recovery than the $A - C$ problems; therefore, let us substitute an $A + C$ task (28, 63, 2, get 30) in place of the usual Problem Nine which is solvable by the $A - C$ method. In the general experiment the first critical following Problem Nine differed from it in the kind of direct method required (#9: $A - C$; C_3: $A + C$). To keep the relationship similar we gave after the new extinction problem an $A - C$ task (C_4), following it by C_3. This set-up was administered to two college classes and one public-school class as shown in Table 20.

TABLE 20

	O's	C_1C_2		C_3C_4		#9	
		E	D	E	D	F	S
Coll. A	28	72	28	30	70	32	68
Coll. B	30	80	20	26	74	23	77
P.S.	30	83	17	83	17	70	30

In the public-school class the extinction task was as ineffective as ever. The comments of the subjects indicate that they sought to employ one method in all the problems, that they thought they were practicing a rule. When such an attitude toward their work existed, an extinction task, whether of an $A + C$ or $A - C$ type, could be of little avail. In the college classes Extinction Effects were somewhat larger than was generally the case.

The results are not very decisive. All we may say is that an extinction task of an $A + C$ type may in some cases produce better recovery. Possible reasons for its greater efficacy are not difficult to find:

1) It takes the subjects' thoughts away from subtraction.

2) It shows that addition can be used.

3) Since it differs from the other (sub-

traction) problems, it may stand out more vividly.

Summary and Conclusions. 1. In the college classes there was in each of the three experiments a marked increase in D solutions of C_3, C_4, C', the criticals following the three extinction tasks. But we have to note that in no case did the E-Effect go below 28 per cent, not even in the critical with the most direct solution, C'. In the public school classes the extinction tasks appeared to be effective only in the second experiment where they had been of the $A + C$ kind, but even here there was 44 per cent E solution of the C' critical.

2. The college classes consistently had more D solutions of the extinction problems themselves than did the public school subjects, and it was only in the second experiment that the pupils showed any considerable solution of these tasks. Some pupils did not solve any of the three tasks. It is an interesting phenomenon in itself that three extinction tasks, one after the other, did not more frequently lead to D solution of the second or third.

3. It seems as if the extinction problems were effective in producing more D solutions only when they themselves were solved. For a systematic study of this matter it would be necessary to fractionize the subjects' responses in such a way that we would take into account the solution or non-solution of each of the three extinction problems: FFF, FFD, FDD, or DDD, and compare the D solutions of C_3, C_4, C' in each of these categories. This was done, revealing two additional cases, FDF, and DFF. Since the number of subjects in each group was small, we shall here present our findings in only a general way. The results indicated that there was the most recovery when all the extinction tasks were solved and the least recovery when none of them were solved. However, there were classes wherein one-third of the subjects who had solved all the extinction problems used the E method in one or more of the subsequent test problems; there were a few subjects who, although failing to solve any of the extinction tasks, solved the subsequent test problems in the D way. Thus, though on the whole there is a correspondence between recovery and solution of extinction problems, solution of these did not in every case lead to D solution of the subsequent criticals and failures did not in all cases lead to lack of recovery. Why a subject should resume the E solution after solving three extinction tasks in the D way we do not know. Perhaps it depends, to a certain extent, on various attitudinal factors.

SECTION 4

A. Separation of Test Tasks from E Tasks by Time Intervals

Experiment 1

If the E problems were separated from the test problems by a time interval of an hour or so, would there be a decrease in E-Effect? If an Einstellung is "the set which immediately predisposes an organism to one type of motor or conscious act,"[37] then we should expect a decrease.

To a 6B class of 35 subjects we administered the usual experiment through E_5, then collected the papers and left the room. After one hour (in the meantime the class had had a geography lesson) we re-entered the room, distributed new papers, and presented the remaining problems of the usual experiment. E-Effects were as large as in the general experiment,

C_1C_2: 70% E C_3C_4: 57% E #9: 60% F.

[37] H. C. Warren, *Dictionary of Psychology*, New York: Houghton Mifflin Co., (1934) p. 371.

In questioning the subjects, we obtained some reasons for the E responses. Many thought that the "second test" was administered in order to see how well they "had learned before" (E session). Nearly everyone remarked about the similarity of the problems of parts one and two and said that they had been aware of it as soon as the first problem of the second set was presented. When part two was given, they tried the "old method," some said, and happy that it was successful, they continued to use it. One or two had difficulty in recalling how they had solved the previous problems and tried very much to remember. But there were some who reported that as soon as the first problem of part two was presented, they saw "the easy method right in front of the nose."

Perhaps if a time interval greater than one hour were used, the E responses to the test problems would be less frequent. Such a procedure was followed in several experiments to be described below, wherein we re-tested subjects who had developed an Einstellung in order to determine whether they would continue to show E-Effect after various lengths of time had elapsed. If the Einstellung is a set which *immediately* predisposes one, etc., we should expect these subjects not to show the E-Effect after some time. In short, these experiments were designed to answer such questions as: Once an individual develops an Einstellung, how long does it endure? Does he continue to use the E method indefinitely or after a period of time does the E-Effect wear off?

Experiment 2

To three 6B classes we gave the usual experiment through C_2. A day later to one, a week later to another, and a month later to still another, we gave only C_3C_4. In the results we used the responses of only those subjects who in the first session solved both C_1 and C_2 in the E manner. How did these subjects who previously had shown E-Effects solve C_3C_4 after a lapse of a day, a week, or a month?

TABLE 21

Class	6B	6B	6B
Subjects	21	28	22
%E C_1C_2	100	100	100
Time elapsed	day	week	month
% E C_3C_4	70	55	27
Difference	30	45	73

The E-Effect fell off with the passing of time,[38] but after one day the results were not much different from those of the usual experiment, and even after one month there was some E-Effect.

Questioning the subjects who gave E solutions the second time we found that a number of them thought they were being tested on their memory of what they had done the first time. They prided themselves on not forgetting.

Experiment 3

After all of the usual problems had been presented by the experimenter to four public school classes, the class teachers presented again C_1C_2 and Problem Nine on both the third and eighth day after the initial experiment. Using only the responses made by those subjects who previously had solved all the criticals in the E way and had failed to

[38] Although one may suspect that the decrease in E-Effect is due to the fact that in the interim the subjects learned of the D method from their classmates who had used it, as far as we know, this did not occur. 1) To begin with, the E-Effects were very large—in the 70's and 80's—and the pupils who used the D method were in the small minority. 2) Intensive questioning at the end of the second session with such questions as, "Were any of you clever enough to learn another way of doing these problems, since I was here?" produced always answers in the negative.

TABLE 22

Class	Per Cent E in C_1C_2				Per Cent Failure of #9			
	$6B^1$	$6B^4$	$5B^3$	$5B^4$	$6B^1$	$6B^4$	$5B^3$	$5B^4$
Subjects	17	17	22	16	17	17	22	16
At first	100	100	100	100	100	100	100	100
After 3 days	82	97	73	100	71	88	45	44
After 8 days	47	29	36	56	18	18	36	25

solve Problem Nine, we find the E-Effects shown in Table 22.

1) Between the third and eighth day there was more weakening of the E-Effect on C_1C_2 than between the first and third day.

2) The failures to solve Problem Nine decreased more in two classes between the first and third day. In two others the reverse was true. These latter classes had less failure after eight days than the two former.

3) Although the E-Effects decreased, they were considerable even after eight days: 29 to 56 per cent E of C_1C_2, 18 to 36 per cent failure of Problem Nine.

Many of these subjects, too, regarded the subsequent presentations of the test problems as memory tests of what they had been "taught" the first time.

Experiment 4

In individually conducted experiments we found that when the criticals were given again immediately after the entire usual experiment, a few subjects, who previously had solved them in the E manner, now gave D solutions and appeared amazed when shown their former E responses; in other cases, however, the E-Effect was shown in the criticals even after time intervals of a day, week, or month.

Conclusions. The separation of the test tasks from the E tasks decreased the E-Effect in some groups but not in others. The results seemed to depend on whether or not the subject thought the second set of tasks a continuation of the first.

In some groups and in some individuals there was no immediate appreciable drop in E-Effect, and in others there was a steep drop. This speaks for hypothesis II, page 28, raising the problem of personality differences: Firstly, some fall victim to a mechanized state of mind more easily than do others; secondly, in some individuals a mechanized habit persists strongly, and in others it wears off rapidly.

B. Separation of Test Tasks from E Tasks by Time Interval Plus Additional Comments

Experiment 1

In the experiments of the previous section the E and test tasks were separated by a time interval,[39] but many subjects still regarded the two sets of problems, not as two, but as one series and showed E-Effect. (Note subjects' comments in this connection.) To reduce the possibility of this view of the problems we conducted the following experiments. The usual set-up was administered through E_5 and after telling the subjects that it was the *"end of the ex-*

[39] This was done in Experiment 1 (page 45) of the previous section. In the other experiments we gave some criticals in the first session. Since these criticals were solved in the E manner by the subjects whose results were reported on, and were, so to speak, "E problems" to them, we may think of the time interval which elapsed as an interval between "E" and test tasks.

periment" (which was not said in the experiments of the previous section) we collected the papers and left the room. After one half hour we returned to $6B^3$ (which in the meantime had had a history lesson), and after one hour to $6A^3$ (which in the interim had had one half hour of work of their own choice; e.g., newspaper reading, followed by one half hour of drill in addition of fractions). On re-entering the classroom we told the subjects that a *new experiment* was to begin (which we had not done in the experiments reported above) and presented as usual C_1 through C_4.

TABLE 23

Class	Interval	O's	C_1C_2	C_3C_4	#9
			E	E	F
$6B^3$	1/2	26	29	15	15
$6A^3$	1	29	48	26	7

The E-Effect on C_1C_2 was slightly decreased in one class but markedly so in the other. In both classes there was a sharp drop in E-Effect on #9, C_3C_4. Surprisingly, there was more E-Effect, in the criticals, in the class in which one hour elapsed than in the class which had the half hour interval. Why this was we cannot say. Perhaps it was due to attitudinal differences between the two classes, or to the drill lesson had by the one hour interval class; or perhaps the decrease in E-Effect is too gross a phenomenon to correspond to so fine a difference as between one half hour and one hour.

Questioning after the experiment brought out the following comments from those who had used the E method: "I thought I had to subtract"; "I thought I had to use all three jars"; "I thought you wanted to see how well I knew the old (E) method"; "I wanted to show you how well I remembered it"; "The old method worked in the first problem, so I used it in the others"; "The old method worked, why should I bother to look for new ways?" And one subject said, "I saw that (the D) method but thought it was too easy and it might be wrong to use it."

Experiment 2

We introduced a change in the procedure of Experiment 1 by rearranging the order of the test problems so that Problem Nine was the first problem presented in the second session. This was done so that subjects would be less likely to think the second set of problems similar to the first because, at the onset, they would have difficulties in trying to use the E method. Thus, three factors were combined in this experiment to help the E problems to be viewed as distinct from the test problems: time interval, remark in second session that new experiment was being given, and "extinction." For the sake of comparison, another class was given the experiment without any time interval between the problems and without the additional remark, but with the problems so rearranged that Problem Nine came before C_1C_2, C_3C_4.

TABLE 24

Class	Interval	O's	#9	C_1C_2	C_3C_4
			F	E	E
$6B^1$	0	20	68	80	80
$6B^1$	½	22	27	16	22
$6A^1$	2	21	10	10	17

The groups with a time interval between the E and test tasks had much less E-Effect than the group which had no time interval. The two hour interval group had somewhat less E-Effect than

the group with the one half hour interval. Although the present one half hour interval group had been given Problem Nine before C_1C_2, C_3C_4, it did not have less E-Effect than the corresponding group of the preceding Experiment 1 (page 47).

The comments revealed some attitudes and assumptions similar to those found in Experiment 1. Some tried to remember the method they had used before, and finally did remember. Note the increase in E-Effect in C_3C_4 as compared with C_1C_2.

Conclusions. When the test problems were separated from the E problems, by means of a time interval and a remark that a new experiment was starting, there was in general, a decrease in E-Effect. But some subjects persisted in viewing the E and test problems as belonging to one series. The results with regard to the effectiveness of various differing time intervals are not clear. This may be attributable to the fact that the number of subjects tested was few and the difference between one half and one hour is not sufficiently great for differentiation.

C. Other Attempts at Separating the Test Tasks from the E Tasks

Below are reported a number of experiments in which a rather extreme method was employed in an attempt to make the test problems be viewed as distinct from the E problems; i.e., the subjects were told that the E problems were characterized by one procedure and the test problems by another. (Cf. hypothesis IV, page 29.)

Experiment 1

In a college class of 20 women students we said, after the illustrative problem and before E_1, "You will receive two series of problems, the first group solvable by one procedure and the second by other procedures. Here is series one." With this, they were given E_1 through E_5 in the usual manner. Then: "Now comes series two to which other methods apply," and C_1, C_2, #9, C_3, C_4 were presented in 2½ minute intervals. At the conclusion of the experiment they were asked to write on their papers answers to these questions: Was there a difference between the problems of the first and second series? If so, how did they differ? Did you use different methods for the two series? What were your methods? If you did not change your mode of solution in the second group, why did you not?

On the basis of their answers, the class could be divided into two groups, those who thought the two series of problems (E and test tasks) alike and those who reported in C_1 or in one of the other criticals or in Problem Nine that they became aware of a difference. The former consisted of 8 students, 4 of whom boasted that they immediately recognized the similarity of the two series of problems. Their results were

C_1C_2: 100% E C_3C_4: 75% E #9: 75% F.

The 12 subjects who said they saw a difference showed

C_1C_2: 38% E C_3C_4: 8% E #9: 16% F.

Another college class of 27 men again gave clear-cut results. Three subjects thought the two series similar:

C_1C_2: 100% E C_3C_4: 67% E #9: 67% F.

Twenty-four claimed that they were aware of the difference between the two series:

C_1C_2: 13% E C_3C_4: 8% E #9: 0% F.

Those who believed that the second series (test problems) differed from the first (E problems) gave less E-Effect than

was made by college groups in the usual experiment. Those subjects in each class, who in spite of the experimenter's assertions, failed to make a distinction between the two, gave large E-Effect.

Experiment 2

We postponed the new instruction until the test problems, so that up to and including E_5, the class of 20 6B children received the general experiment. After E_5 we said, "Now you will be given a new set of problems solvable by methods other than the one you've been using up to now." Their papers were collected, new ones distributed, and C_1 through C_4 presented. E-Effects did not decrease but were as large as in similar groups of the general experiment:

C_1C_2: 80% E C_3C_4: 80% E #9: 60% F.

Asked why they did not find another method, even when told of new possibilities, they said, "I saw no difference"; "I tried the old method and it worked, so I used it"; "It still gave me the right answer"; etc. The children referred to the problems as "subtraction examples," one of them putting it so: "All you do is subtract and you always get the answer." The viewing of the problems as subtraction examples may explain the higher per cent of E in the $A + C$ criticals than in the $A - C$ criticals (70 per cent E in C_1C_4 but 90 per cent E in C_2C_3). Some subjects were apparently unaware that an additive solution existed.

This procedure was not successful. We need a set-up which will make the distinction more obvious to the subjects.

Experiment 3

After the illustrative problem a 6A class of 20 subjects was told that they were to receive two groups of problems, the first group solvable in one way, and the second group in entirely different, easier, and better ways. "The problems of both groups will look alike, but if you keep your eyes open, you'll see that different methods can be used in the second group." After E_5, we collected the papers and handed out new ones, saying, "We have finished the first set. Now come the examples that have different solutions."

Questioning after the experiment revealed that only 2 subjects saw any difference between the two series. These 2 gave D solutions to each of the test problems. The 18 others wrote that the two series were "the same"—each used the term "subtraction" to describe the problems. These 18 had E-Effects as large as in the general experiments:

C_1C_2: 92% E C_3C_4: 80% E #9: 56% F.

They showed more E in the $A + C$ criticals than in the $A - C$ criticals.

It is well to note, in connection with the large E-Effect and the characterization of the problems as subtraction examples, that even in the grocery store introductory problems (see page 10) the children showed signs of guessing a procedure or a process. Instead of looking at the task, they shouted out, "divide-multiply-add-subtract" even in those instances where only one jar had to be filled. At first glance they hurled "processes" at the problem and we had to caution them to examine each problem before deciding on what to do. Thus, early in the experiment we noticed the operation of a school-acquired method of dealing with problems which might have produced the results.[40]

[40] The teacher of this class later informed us that the assistant principal, who is in charge of arithmetic supervision, has instructed the teachers to have the children name the process involved before they do the work. If they are unable to do so, they are marked "incorrect" even though they do solve the problem. Perhaps the children's be-

Experiment 4

In another sixth year class we followed the procedure of Experiment 2 but made the instruction after E_5 more pointed. After collecting the papers when the E tasks were completed, we told the subjects to formulate the method they had used. We then said, "Try not to use it hereafter. I'll give you one minute to make up your mind not to use it any more." New papers were distributed, and with each test problem they were told, "Look for the new ways. Do you see a different method? Write after your answer whether or not you found it."

We separated the subjects into those who wrote, in answer to our questioning, that the problems of the first and second series were dissimilar, and those who thought the problems the same, who said that the previous method still worked, that all the examples were subtraction examples, etc. In this manner, we had two groups of 12 subjects each. The half that claimed they saw the difference between the E and test problems had little E-Effect, the others had very large E-Effect.

TABLE 25

	C_1C_2	C_3C_4	#9
Saw Diff.	17% E	4% E	8% F
Saw No Diff.	75% E	75% E	50% F

Experiment 5

In order to make the dichotomy between the E and the test problems more noticeable we said with each E task, "Remember, in this group the examples can all be solved by one method. Just think of the method you used before. It will work here too." When the subjects were asked, after E_5, to formulate the "rule" which they had used, most of them wrote, "subtract," some specified how to subtract. (Cf. experiments in Section 11, pp. 67 to 69.) Before going on with the criticals we said, "Now turn over your papers. On this side of the page you are going to do the second group of problems. These also involve the measuring of water, but in these there are other and better ways of getting the water. Let us see if you can find them." With C_1 and C_2 we cautioned, "Look for the better way to do it. Write whether or not you have found it." (Some children wrote on their papers or called us over and told us, "There is no other way. You can still get the answer by the old method —by subtracting.") In Problem Nine we said after 11½ minutes, "I told you that there is a new and better way to do these problems, but some of you did not believe me. Because you did not look for a new way, you are now having trouble." C_3C_4 were administered as C_1C_2.

Twelve of the 25 sixth-year pupils informed us: "There is no new way"; "All the problems are the same"; "All are subtraction examples"; "I can't find any new way"; "The old method works, it still gives the correct answer." They had

C_1C_2: 100% E C_3C_4: 71% E #9: 67% F.

The other 13, who wrote that they noticed that the two series were not the same, had

C_1C_2: 12% E C_3C_4: 8% E #9: 8% F.

and those of the 13 who in C_1 already reported that they saw a difference gave 0 per cent E in all test problems.

havior in our experiment was influenced by this training. Once they guessed that the answer was obtainable by subtraction, the problems became subtraction examples to them. When the second series of problems was given, it looked just like the first series of "subtraction examples," so they guessed "subtraction" again—and it worked. As long as they could name the process, and the process gave an answer, there was nothing to worry about.

Experiment 6

In the most extreme variation, this procedure was utilized. With the E tasks a sixth year class of 24 pupils received the same instructions as the class of Experiment 5. After they had formulated the "rule" (see experiments in Section 11) they had used, in order to make certain that they understood what the E method was, the jars and arrows; viz.,  were drawn on the blackboard. The class was then told that they were to be given a new set of problems which was solvable in other and *better* ways, and in which they must not use the old (E) method. "DO NOT USE IT ANY MORE," was printed on the blackboard. "Remember, not the answer, but the way you get the answer counts. If you try to use the old method, you are wrong. Do not use it. There are other and better ways of solving the problems. I want you to find them."

A minute or so after this admonition, C_1, C_2, #9, C_3, C_4 were presented in 2½ minute intervals. When they had completed C_4, the subjects were asked to indicate whether in spite of the instructions they had persisted in viewing the two series as one. Fourteen answered in the affirmative, 10 in the negative. Of these 10, 7 had D solutions in every test problem, one gave all E solutions, later saying that he never thought of whether or not his method was like the previous one, and 2 used the E method in some criticals, stating that "subtraction came naturally" to them. The results of the 10 subjects who did not view the two series as one were

C_1C_2: 15% E C_3C_4: 20% E #9: 10% F.

Examining the responses of those subjects who said that they regarded the E and test tasks as belonging to the same series, we found a few claiming that the E method kept "popping up" in their minds, and that they could not help using it, but many others admitted that they used it because they could see no other solution offhand or because they did not care to start searching for other solutions while the old one still sufficed. These 14 subjects showed a large per cent failure to solve C_1C_2 and much less D solution than the other 10 subjects,

C_1C_2: 14% E and 53% F. C_3C_4: 49% E. #9: 64% F.

The procedure described above was also followed in a college class of 22 students. Seven claimed that they viewed the two series as one; 15 said they did not. The failures of criticals, found in the public school class, were not evident here, but as in the younger group, the former subjects gave more E-Effect than the others.

TABLE 26

	O's	C_1C_2	C_3C_4	#9
		E	E	F
Same	7	43	43	43
Diff.	15	0	0	0

Of interest is the fact that in the college class only 7 of 22 but in the public school 14 of 24 subjects reported that they regarded the E and test problems as belonging to one set. Perhaps the difficulty of the task was an important factor here. The pupils were of lower I.Q. (in the public school very few had I.Q.'s above 100; in the college class all had I.Q.'s above 120) and, of course, of a lower educational level. Thus, it may be that because the children had difficulty in finding a new method, they thought of their previous solution and went back to it; but it may also be that because of the repetition of the E method

they had difficulty in discovering a new solution.

Conclusion. 1. One sees that such additional instructive remarks as made in these experiments between the E and test tasks can open the eyes of the subjects to the D way. Sometimes the attempt to make a distinction between the E and test tasks was vitiated by the subjects' attitudes; they desired to repeat a method throughout ("Why search for new ways when the old way works?") and wished to group all the problems under one procedure ("They're all subtraction examples").

2. In college groups the instruction seemed to help more readily to make the subjects see the difference between the E and test problems, if we are to judge by the greater percentages of college students who said that they did not think the two series of problems to belong to one set.

TABLE 27

	O's	1 thought them same	2 thought them different
College Exp. 1	20	40%	60%
College Exp. 1	27	11%	89%
College Exp. 2	22	32%	68%
Elem. Exp. 2	20	100%	0%
Elem. Exp. 3	20	90%	10%
Elem. Exp. 4	24	50%	50%
Elem. Exp. 5	25	48%	52%
Elem. Exp. 6	24	58%	42%

We see that a smaller percentage of the college classes fall under column I and a larger percentage under column II than was the case for the elementary school classes. Perhaps this explains why in the college groups this method seemed on the whole to be more effective in producing decreased E-Effect.

We must add that not all of those who said they saw the difference between the E and test tasks gave D solutions—they too showed some E-Effect. Also, not all who thought them the same gave E solutions.

SECTION 5

Speed Experiments[41]

In conducting the general experiment in the public schools we were often impressed by the tenseness many of the children showed and the speedy responses they gave. In spite of our statements to the contrary they viewed the experiment as a "test," and evinced nervous, fearful, and competitive behavior. One can ask whether the E-Effects were due to just these conditions that existed in the experimental situation. That is, maybe the E solutions in the test problems are not the result of a general tendency to mechanization, but, a response manifested only under conditions similar to those of the experimental session: hurry, tension, striving to finish quickly or first, competition, test-attitude, fear (hypothesis II, page 23). It may even be an intelligent response to such conditions, the subject reasoning that he will get through quickly, or will finish first, etc., by repeating a previously mastered process, and that more time will be consumed if he stops to look for new methods (hypothesis III C, page 29).

These assertions imply that E-Effects would be smaller if such conditions of haste, fear, tension, and the like were diminished, and greater as these conditions were intensified. We attempted first to rule out the nervousness and haste; but, our attempts were unsuccessful. Therefore, we decided to increase these factors by creating to a greater extent the

[41] The results of these experiments have been corroborated in subsequent experimentation, with a modified technique, by Professor S. E. Asch. He has reported his findings in the April 1940 meeting of the Eastern Psychological Association.

public school atmosphere in the college classes, and by strengthening the already described conditions of the public school classes.

Preliminary investigations indicated that the social atmosphere which existed in the public school could quite effectively be introduced into college groups (which, on the whole, had been relatively free from tension, nervousness, etc.) by making a "speed test" out of the experiment.

Experiment 1

In one college class we told the subjects that they were to be given a series of problems for each of which they would have about one minute; and the aim was to see whether, in spite of the speed, they could get all the problems correct. Time allotments for the problems were actually as follows: (E_1) 2½ minutes, (E_2) 1½ minutes, (E_3) 1 minute, and ¾ of a minute each for E_4, E_5, C_1, C_2, #9, C_3, C_4. The E-Effects were greater than in college groups of the general experiment.

23 subjects C_1C_2: 100% E C_3C_4: 100% E #9: 100% F

Out of a class of 35, 12 failed to solve E_4,E_5.

The subjects claimed that they had to hurry in order to finish the problems, they soon found that one method could solve them all, the E method "became natural" to them, they had no time to think, and therefore they failed Problem Nine.

Experiment 2

College classes were told that they were to be tested in their ability to solve problems quickly. After E_1 had been illustrated it was said that they would be timed while solving problems (E_2 through C_4) all of which had previously been written on the blackboard. The passing of time was indicated by the large laboratory clock at the front of the room, by the recording of the minutes on the blackboard, and by three stopwatches on the instructor's desk. As soon as each subject finished he was to bring up his paper to the experimenter so that his time of completion could be recorded and the paper collected.

The E-Effects were in most cases greatly increased. And, for the first time, college subjects used the E method in Problem Nine. As a whole, there was now 14 per cent E "solution" of this problem.

TABLE 28

Plain				DBB			
O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
	E	E	F		E	E	F
11	86	62	82	8	75	63	50
8	87	67	75	9	67	94	44
10	90	90	60	7	100	100	86
10	100	100	90	10	75	100	70
8	100	100	100	8	75	75	75
10	100	100	90	12	100	100	100
12	100	100	92	8	94	50	75
10	100	100	90	7	86	71	86
11	100	100	82	7	79	51	72

Observations. During the experimental session, tension and nervousness were observed and the subjects themselves spoke of rushing and hurrying and complained that their nervousness prevented them from thinking and being accurate. Some of the reactions to Problem Nine also testify to this: "I skipped it so as not to waste time"; "I saw it was wrong, but I left it that way." The comments of some DBB subjects revealed that they had forgotten the warning or had not been able to heed it because of emotional disturbances.

Rapidity of solution was no indication that an Einstellung had been developed. In fact, in two of the classes the first subject finished had D solutions of every test

problem. It was seeing others hand in their papers, some subjects said, that intensified their fear and nervousness—and the tension did appear to increase with the number of students handing in their papers. Mocking laughter at the expense of the students still working was not infrequent, and those who seemed most perturbed were usually the remaining few who often accompanied the handing in of their papers with such remarks as: "I give up"; "It's got me"; "Take the paper"; and sometimes threw their papers on the floor or flung them at the experimenter. Very few in number were the subjects who claimed that they felt at ease. This was in sharp contrast to the rather carefree atmosphere which existed in college classes during the general experiment. We believe it was not speed alone, but speed plus the accompanying tension, anxiety, and competition, which was responsible for the increase in Einstellung.

Experiment 3

A "speed test" experiment was also conducted in seven public school classes. The procedure of Experiment 2 was employed. The children were told in addition that the principal and teachers were interested in this test and would examine their papers. Report card grades were connected with their success on the test. After the class had been working two minutes we erased the first problem, saying, "You should have finished this problem long ago." At frequent intervals they were told, "Aren't you finished yet? You are very slow. Four-A children did better than this," etc.

The E-Effect was in every case larger than that usually obtained in the general experiment. Only 2 of the 98 subjects in the Plain group solved C_1C_2 in the D way, and only 3 solved Problem Nine. In the DBB group, 1 subject out of 98 did not show any E-Effect.

Observations. The public school groups of the general experiment had not been free of fear and nervous tension.

TABLE 29

Plain				DBB			
O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
	E	E	F		E	E	F
11	100	100	100	12	100	100	100
11	100	100	100	10	90	100	100
15	100	100	100	16	100	100	100
18	100	100	93	14	100	100	100
13	100	100	100	15	93	93	93
16	94	94	94	18	100	100	100
14	93	93	93	13	100	100	100

But in the "speed test" groups this was even more marked. Great anxiety, haste, and competition were observed; faces were strained, pencil points broke, many children moaned and groaned and a few even wept. All comments told of their being fearful, worried, upset, and some dramatically proclaimed that they were so frightened they thought they would die, that all they could think of was subtraction, that their minds were in a constant whirl, and that they hoped never to get such a test again. The difference between the atmospheres of the two experiments, rather than sheer speed in and of itself, probably contributed to the larger E-Effects.

Experiment 4

In order to control to some extent the factor of group competition, we administered the "speed test" experiment individually to 14 college students. Every subject used the E method in C_1C_2, and 12 of the 14 failed to solve Problem Nine and used the E method in C_3C_4. Again speed exerted a deleterious influence on the subjects' behavior. And again the

same tenseness, nervousness, and hurry were seen. They were disturbed, some confessed, by the fear that they would be considered stupid if they did not finish quickly. It is interesting to note that some worked hurriedly so as not to fall below a subjective norm that they had set up for themselves (competition?).

Experiment 5

A 6B class which had participated in the usual experiment three months before was given the experiment in the form of a "speed test." E-Effects were now 100 per cent in the criticals and greater than before in Problem Nine.

TABLE 30

	O's	C_1C_2	C_3C_4	#9
		E	E	F
Usual	35	60	51	40
Speed	35	100	100	88

Conclusions. Decreasing the time allotment per problem and making subjects work against time did increase the E-Effect and minimize the efficacy of the recovery factors (Problem Nine and the instruction, "Don't be blind"). The results cannot be taken to mean that a speedy response necessarily led to E responses (some of the first subjects finished in the college classes showed no E-Effect). How the individual reacted to the speed factor was important. Many of our subjects, both public school and college students, were emotionally upset by the "speed test." They showed signs of nervous haste, competition to finish quickly or first, and fear that they would not make out well or would be among the last to finish.

It may be that under such conditions the individual is so intent upon discovering a procedure which will give a quick and ready answer to the problems, that once he finds a response (e.g., E method) he may continue using it without troubling, or for that matter, without being able to seek for a new method. Fear and nervousness are not exactly conducive to a critical attitude of solving problems; more likely, they so narrow the individual's mental field that he is blinded to a more direct method. The emphasis on speed may make getting through more important than accurate responses: "I knew Problem Nine was wrong, but I left it that way," or "I handed in my paper without solving Problem Nine. It took too much time" (comments obtained in college classes). Those who do observe that the E method fails to solve Problem Nine may attempt to discover another method, but the strong pressure "to get finished" may make them "go to pieces," and render them unfit for any more work. For example, there were subjects who stated that Problem Nine so upset them that they could not easily continue with the remaining problems (C_3C_4). Thus, it seems that the introduction of speed created conditions which hindered careful thinking and favored mechanization.

(We do not wish to over-emphasize the implications of the speed experiments, but neither do we desire to minimize them. They clearly indicate that we are in need of a more careful analysis of the value of a speedy response, a factor stressed in our culture, in our schools, in class tests, and in intelligence tests. Without denying that speed may have its advantages, we point out that it is disadvantageous when it helps to mechanize the individual and to routinize his behavior so that he is blinded to a more direct method of solving problems.)

SECTION 6

Non-Speed Experiments

In the usual experiment the subjects were timed (no more than 2½ minutes was allowed per problem). They may have reacted to the factor of timing in this manner: "I have to hurry"—"I have no time to think it over"—"I just have to do it quickly." They, therefore, did not allow themselves to survey the situation and to try to find out which was the best possible solution or whether there was a method other than the just repeated E method. It could even have been an intelligent decision: because the time is too short one should not try (it is not practical) to find a better way to do it; the previously used method will suffice (hypothesis III C, page 29).

Against the above-stated formulation the following speak: In many classes the subjects did finish the task before the 2½ minutes were up. They did not work at the problem any longer; they considered it finished and waited impatiently for the next one. In some classes the subjects so hurried the experimenter that he had to go on to the next problem within one minute. Notwithstanding this qualitative evidence, we decided to test experimentally the effect of eliminating timing.

Experiment 1

In two public school classes the subjects were not timed, but, on the contrary, they were told that they should take as much time as they liked in order to give the best possible solution to each problem. The next problem would not be presented until everybody had finished and was satisfied with his work. The extra time was to be spent in examining anew the problem on the blackboard and in looking over their solutions to make certain that they had the best answers. As we went from problem to problem, we asked, "Are you sure you don't want to work on it any longer; are you satisfied with your answer?" The pupils worked slowly, taking from 3 to 6 minutes for a problem. In Problem Nine, after about 10 minutes, we told them that it was taking a bit too long and that we would therefore discard the example, and continued with C_3C_4.

TABLE 31

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
5A[1]	12	92	87	96	11	91	91	95
6B[2]	18	89	100	78	14	100	89	93

The E-Effects did not decrease but were as large as those shown by similar groups in the general experiment.

Experiment 2

The E problems do not have a more direct method of solution. Subjects who had followed the experimenter's advice in the E tasks therefore sought in vain to improve their answer and might have given up the attempt by the time the criticals appeared. To prevent this, E_1 to E_5 were presented in the usual manner, but when C_1 was given we remarked, "Don't hurry. We won't go on to the next example until you have all finished

and are satisfied with your work." (This addition may have helped to make the subjects view the test problems as distinct from the E problems.) After five minutes all were finished and "satisfied." Those who finished first we cautioned, "Look over your work. Be sure it's the best you can do." On the blackboard we wrote, "Look for the best way to do the example." This procedure was used in all the criticals and in Problem Nine. The subjects worked slowly, taking from 4 to 6 minutes for a critical; after 10 minutes they were told that Problem Nine would be discarded, and C_3 was then presented. Again the E-Effects were as large as in the general experiment.

Experiment 3

The procedure of Experiment 2 was repeated with a class of 31 college students. Compared with the responses of the similar groups in the general experiment, there was somewhat less E solution of C_1C_2, and decidedly less failure of Problem Nine and E solutions of C_3C_4, but the E-Effect was still apparent,

TABLE 32

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
5A[3]	16	75	75	75	16	84	84	84
6B[4]	13	92	92	69	14	100	100	43

After both Experiments 1 and 2, the subjects were shown the D method, and asked why they had not used it. In general the answers were: "How were we supposed to know what you meant by a better answer or by being satisfied?" "We were satisfied—we had done our best to check the arithmetic and to see that the answer was correct, clearly and neatly written."

The above leads us to suspect that more time, in and of itself, does not help. It is the use made of the time which is important. It may be used for mechanical operations, to check up on the arithmetical computations, to write the answer more neatly. But it may be spent in creative work, in searching for new methods of attacking the problem. Our subjects spent their time in the former and not in the latter manner. Can it be that in the classroom they have been accustomed to having much stress placed on such mechanical matters? Perhaps college students and pupils of different personal and educational backgrounds will give different results.

Experiment 4

To make sharper the distinction between the E problems and the test problems we conducted the experiment as a *speed test* up to E_5 (see page 53 for procedure followed), but beginning with C_1 we used the set-up of Experiment 2, telling the class that there was no need for hurrying, that they were now not being timed, but had as much time as they de-

C_1C_2: 61% E C_3C_4: 34% E #9: 35% F.

The comments of a number of subjects told of their not understanding the point of the instruction until they came to Problem Nine. Others said they completely failed to see the relevancy of the instruction or the need for extra time in the latter problems since they were the same as the former.

sired and should spend it in looking for the best answer. In a college summer evening session class of 35 juniors and seniors, from 2½ to 5 minutes was taken per critical. There resulted a somewhat smaller per cent of E solutions in C_1C_2 and much less failure of Problem Nine than usual, but the E-Effect was still considerable,

C_1C_2: 60% E C_3C_4: 43% E #9: 34% F.

Some comments in this class, too, told of confusion about the meaning of a "better way" and about the reason for the extra time allotment.

Experiment 5

In an attempt to overcome this confusion, we first told one half of the subjects (DBB group) that after the sixth problem they would be told to take their time and to look over their work. When this was done, they should use the extra time to seek a more sensible and *more direct* solution to the problem. After this instruction, the entire class, DBB and Plain groups, was given the experiment, the procedure being that of Experiment 4: speed until E_5, no timing with C_1, C_2, #9, C_3, C_4. The Plain groups showed E-Effects in C_1C_2 and Problem Nine similar to those of college groups in the general experiment. But when we consider all of the DBB groups' responses and the Plain groups' solutions of C_3C_4, we see very good recovery. The Einstellung here developed was more easily weakened by Problem Nine and the new "Don't be blind" instruction.

Conclusions. How strong an Einstellung was developed depended on how the subject interpreted a "better answer" or being "satisfied with your answer," on how he spent the extra time; on his attitude in dealing with the problems; on such factors as were included in hypothesis V, p. 30. More time per problem was not, in and of itself, sufficient to decrease the E-Effect.

TABLE 33

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
B'klyn Coll.	18	75	37	50	24	32	20	25
L.I.U.	19	66	32	32	15	27	13	20

SECTION 7

Positional Set

In every problem of the general experiment the jars were written on the blackboard in the same succession; i.e., the largest jar in the center, the smallest jar to the right, and the second smallest to the left of it. Therefore, it may be that the E-Effect was facilitated by a positional set. Experimental variations were made to rule out the possibility of the development of a positional set.

Experiment 1

The order of the jars in the E problems, but not in the criticals or Problem Nine, was rearranged so that the largest jar was never in the center but on either end. Designating the usual order of the jars by the letters A, B, C, the new order in the E problems can be expressed as follows: (E_1) BAC, (E_2) BCA, (E_3) ACB,

(E_4) BAC, (E_5) ACB. There was now the possibility that the subject's attention would be directed to filling first the end jars, but such orientation would favor D solution in the criticals and Problem Nine.

TABLE 34

	O's	C_1C_2	C_3C_4	#9
		E	E	F
Coll. A	23	90	45	56
Coll. B	17	78	30	42
H.S.	28	74	54	48
5A[3]	7	86	86	86
6B[3]	13	92	92	85

In spite of this change, when the experiment was conducted in two college, one high school, and two public school classes, the E solutions in C_1C_2 did not decrease; the failures to solve Problem Nine were, with the exception of the high-school group, as large as those obtained from similar groups in the general experiment, as shown in Table 34.

Experiment 2

In another variation made to rule out the position factor, the order of the jars in the E problems was not changed, but the jars were rearranged in the test problems: (C_1) ACB, (C_2) BAC, (#9) ACB, (C_3) BAC, (C_4) ACB. The development in the E problems of a set to start from the middle jar would not now favor E solution in the criticals and Problem Nine. Another feature was here introduced: since the two jars required by the D method were neighbors, theoretically (on the basis of the theory of fundamental arithmetical number combinations) we should expect the D solution to be favored. But, when the experiment was presented to one college and two public school classes, except for a decrease in E solutions of C_3C_4 and Problem Nine in the college DBB group, the results, as shown in Table 35, were similar to those made by equivalent groups in the general experiment.

SECTION 8

Assumption That All Three Jars Must Be Used

The E-Effect was perhaps due to a misunderstanding on the subject's part, that he must employ all three jars in each problem.[42] Believing this, he would not, of course, use the D method, which involved only two jars, even when aware of it.

TABLE 35

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Coll.	12	75	50	65	10	50	30	30
5A[1]	12	92	87	89	11	91	91	82
4B[1]	7	100	100	86	18	100	100	86

Experiment 1

If this were true, it follows that the E-Effect should decrease if one knew that it was not necessary to use all three jars.

[42] But in the general experiment the subjects had been told that they might employ *any* of the given jars, and this was further illustrated in E_1 by showing two solutions, the E method involving three jars and a second method requiring only two jars. (Of course the E method, 127-21-3-3, is more sensible than 100 — (9 × 3); see page 5.)

In several college and public school classes we gave the subjects this information by saying with each problem (E_1 through C_4), "Using one, two, or three of these jars, how would you obtain the required volume of water?" Though the subjects' reports indicate that they well understood that they might use two of the given jars, there was no decrease in E-Effect in the Plain group. Recovery factors were more effective, on the whole, as shown in Table 36, than in the general experiment (note College B DBB group), operating positively in most cases, even in the public school groups.

TABLE 36

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Coll. A	18	75	58	45	11	82	36	45
Coll. B	8	100	38	75	4	13	0	0
Coll. C	8	88	19	50	14	36	7	0
6A[1]	23	91	72	70	13	76	65	61
6A[4]	8	100	100	87	9	67	78	67
6A[3]	12	75	54	58	13	69	69	77

Experiment 3

Instead of attempting to prevent an assumption about the use of three jars from arising, we so changed the experimental set-up that such an assumption could be just as conducive to D as to E solutions. This was done by employing a new set of problems in which both E and the D method in the criticals involved all three jars (see par. 3 of page 94 for the problems). Of course, the difference between the new E and D meth-

TABLE 37

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Coll. A	12	67	25	37	13	34	8	15
6B[1]	13	64	64	43	8	63	63	63
6B[3]	16	75	66	62	10	80	80	40
5B[4]	10	80	80	70	10	90	90	100
5B[3]	12	100	100	96	10	100	100	90

Experiment 2

Giving the phrase, "Using one, two, or three of these jars, etc.," in the E problems where three jars were always required by the E method might have made of it by the time the criticals came just a trite and meaningless phrase. Therefore, we presented it with the criticals and Problem Nine, and did not give it with the E problems. (This sudden insertion of new instructions with C_1 might also have helped to make the subjects view it and the subsequent problems as distinct from the preceding E problems.) With this variation, however, the E-Effects in C_1C_2 did not decrease considerably; in the other test problems some of the groups showed improvement. See Table 37.

ods is not so great as between the original E and D methods. These new problems were used in three college and one 6B class. The subjects were told before any problems were presented that they must use all three jars as measures. E-Effects resulted as large as those of comparable groups in the general experiment (the college groups showed better recovery in most cases). See Table 38.

E_5: $59 - (7 \times 4) = 31$ instead of $59 - 20 - 4 - 4 = 31$.

These 14 gave much less E-Effect than did similar subjects in the general experiment,

C_1C_2: 11% E C_3C_4: 7% E #9: 0% F.

The remaining 18 subjects, who solved the E problems in the E manner, had more E-Effects,

TABLE 38

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Coll. A	9	83	72	78	9	78	44	56
Coll. B	8	75	44	50	5	40	0	0
Coll. C	10	75	30	50	15	40	17	0
6B[1]	17	100	100	100	19	95	95	95

SECTION 9

"You Do Not Have to Use the Largest Jar"

Experiment 1

With every problem (E_1 through C_4) the subjects were told, "You do not have to use the largest jar if you do not want to." But, in spite of this instruction, a sixth year public school class of 32 pupils gave as much E-Effect as public school groups in the general experiment,

C_1C_2: 75% E C_3C_4: 75% E #9: 66% F.

Their comments indicated that the phrase was more or less meaningless and confusing to them or that they completely ignored it. Some insisted that they had to use the largest jar.

In a college class, however, the results were quite different. Here, 14 of the 32 subjects showed non-E solutions even in the E problems, solving E_4 or E_5 or both in a non-E manner,

E_4: $9 + 6 + 6 = 21$ instead of $42 - 9 - 6 - 6 = 21$.

C_1C_2: 47% E C_3C_4: 16% E #9: 6% F.

But both groups of subjects in this college class showed less E-Effects than similar subjects of the general experiment.

The comments of the subjects indicated that in the E tasks already some of them were put on guard by the statement concerning the largest jar; they sought other methods of solving the problem, and tried not to employ the largest jar. A few subjects said they saw no sense in the statement; it meant nothing to them —or it meant nothing to them till one of the criticals or Problem Nine was presented.

Experiment 2

Perhaps if the instruction concerning the largest jar were introduced at the crucial time of the experiment, with the first test problem, it would be more successful. (This method is complicated by the fact that the added instruction might now serve as a break, separating the E and test tasks.) Therefore, beginning

with C_1, and in every problem after that, the subjects were told, "You do not have to use the largest jar if you do not want to." The fourth year public school and college classes in which this procedure was followed showed less E-Effect than did corresponding groups of the general experiment.

TABLE 39

	O's	C_1C_2	C_3C_4	#9
		E	E	F
P.S. 4A	10	25	20	10
Coll. A	30	25	18	10
Coll. B	34	29	23	0

Many of the public school children stated that when they first heard about the largest jar, they quickly and suddenly became aware of an "easier," a "shorter," or a "better" way.

The college students had been told to answer these questions: Did the change in instruction after the sixth problem affect your subsequent work? In what manner? Did you change your mode of attack after the sixth? Why? Their answers indicate that the new instructions,

(1) Made many expect that a different kind of problem would follow.

(2) Made a new method become obvious, caused them to view the problems in a new light; the largest jar no longer played any role—it dropped out of sight.

(3) Made them suspicious so that they stopped and looked twice before writing an answer.

(4) Led one subject to think he was not allowed to use the previous method any longer and caused him to seek new procedures.

There are two possible explanations of the results,

1) The main factor in the Einstellung phenomenon witnessed in this experiment is the assumption, made by the subject, that he must begin with or must employ the largest jar. Because we here gave instructions to the contrary, the E-Effect decreased.

2) Perhaps this is not at all the case. It may be that what actually occurred was that by telling the subjects with each problem (or each test problem) that they did not have to use the largest jar, we caused the subjects to instigate a search for new methods (cf. Section 10, pages 63 to 67), for methods which did not involve the large jar, for methods other than the E method. And so, the instruction might have been a factor working against E solutions.

Until further experimentation is carried on, we cannot decide which of these two explanations is decisive. But the subjects' comments point in the direction of the second.

SECTION 10

A. Fore-Period in Which the Same Set of Jars Are Used to Obtain Various Goals

At the end of the usual grocery store introduction (see page 10), a 6B class of 40 pupils was presented with the following task, "If you had in your store only these jars for measures, 8, 7, and 30 quarts, how would you measure 15 quarts of milk?" Different customers come in asking for 1, 21, 24, 23, 22, and 29 quarts of milk. Three minutes was allowed for each problem. After this, the usual experiment was administered, but no decrease in E-Effect was found,

C_1C_2: 80% E C_3C_4: 75% E #9: 65% F.

It was hoped that the subjects, seeing that in the first few problems all the jars did not have to be used in a solution, and that the same jars could be used in various combinations, would develop a flexibility of mind which would aid them

in the criticals. But what actually occurred was that the subjects looked for, found, and stuck to one method of solving the problems. Again we see the working of this attitude toward the problems of the experiment, which could not be overcome by the methods we employed.

B. Fore-Period in Which Various Methods of Solution Are Required for Each Problem

Will the E-Effects decrease if before the usual set of problems the subjects are given problems in each of which their task is to find many different methods of obtaining the answer? Three such problems were presented to a 6B class of 36 subjects at intervals of five minutes:

	15	5	30	get 20
18	7	5	2	get 9
	16	8	4	get 12.

After each problem we demonstrated some of its various solutions; e.g., problem one: $15 + 5$, $30 - 5 - 5$, 5×4; problem two: $7 + 2$, $5 + 2 + 2$, $18 - 7 - 2$; problem three: $16 - 4$, $8 + 4$, 4×3. Some of these solutions are D solutions. Then the problems of the general experiment were given, in the usual manner and succession. The E-Effects were not considerably changed, as compared with similar groups in the general experiment,

C_1C_2: 67% E C_3C_4: 67% E #9: 56% F.

We had hoped to make the subjects realize that more than one method was possible in these problems. But what actually occurred, as indicated by their comments, was that they welcomed the E problems because they were all solvable by one method. The three initial problems were evidently not sufficient to overcome the attitude of seeking one formula or procedure to solve the set of problems.

C. Various Solutions Required for the Problems of the Experiment

Experiment 1

Will the E-Effect decrease if the subjects are told to find as many different solutions to the problems of the experiment as possible? This instruction can work against Einstellung and for direct solutions by focusing the subject's attention on the fact that there may be other ways of solving the problems. Will the subject give the direct solution as his first answer to the criticals, using the E method only after it?

When the direction to discover various solutions was issued with every E and test problem to a class at Brooklyn College and at Long Island University (3 minutes allotted to a problem), E-Effects, though less than shown by similar groups of the general experiment, were still observed: 1) two-fifths of each group never found the D method but to give the appearance of different answers wrote the E solution in various forms; e.g., $B - A - 2C$, $B - 2C - A$, $B - C - A - C$, $B - A - C - C$, $B - C - C - A$; 2) when the D solution was made, it usually was preceded by one to three of the above "variations" of the E method. See Table 40.

Experiment 2

About the only solution that the subject could find in the E problems was the E solution. Thus, by the time the subject came to the criticals, he might have begun to ignore the instruction to find various methods or have looked upon it as impossible to follow. Furthermore, with three minutes at his disposal, the subject might have resorted to rewriting the E method, making for more repetitions of this procedure. Therefore, subjects were told with each problem to find

TABLE 40

Per Cents of Solutions Which Were:	L.I.U. 11 Subjects			Brooklyn College 10 Subjects		
	C_1C_2	C_3C_4	#9*	C_1C_2	C_3C_4	#9*
Only E	41	41	27	40	40	40
Only D	0	0	37	10	25	20
D, then E	32	55	9	20	25	20
1 E, then D	14	0	27	20	10	10
2 E's, then D	9	0	0	5	0	10
3 E's, then D	4	4	0	5	0	0
Total	100	100	100	100	100	100

* In Problem Nine "Only E" indicates failure, "1 E, then D," "2 E's, then D," etc., mean there was a solution after one or more failures.

as many solutions as they could, but in the E problems were given time for only one writing of the E method; beginning with C_1 they were allowed 3 minutes per problem. Of the 10 college subjects studied individually, 4 never used the D solution in the test problems. The other 6 found the D method only after spending from 2½ to 2¾ minutes in writing the E solution in different ways, and the time that elapsed before the D method was discovered did not decrease appreciably as they went from C_1 to C_4, in spite of their finally having hit upon it in the first critical.

When the test problems were presented in this manner, without the previous E problems, the 5 college subjects studied always gave the D solution as their first answer, usually within ½ minute, and only after 1½ to 2⅓ minutes did they show an E response. Furthermore, all gave $6 \times 3 = 18$ in answer to C_2, and one gave $76 - (17 \times 3) = 25$ for Problem Nine, solutions never used by the 10 experimental group subjects.

Experiment 3

In order to make a sharper distinction between the E and test problems and to give the instruction when there was a possibility of finding the direct solution, we conducted the following variation. Beginning with C_1, but not in the E tasks, the subjects were directed to find different methods of solution. The time in the E problems was 2½ minutes and in the test problems 3 minutes.

The results are shown in Tables 41, 42 and 43.

TABLE 41

Per Cents of Solutions Which Were:	C_1C_2		C_3C_4		#9	
	Control	Exp.	Control	Exp.	Control	Exp.
Only E	0	25	0	31	0	0
Only D	70	0	78	5	100	72
D, then E	23	41	19	44	0	0
1 E, then D	7	26	3	14	0	0
2 E's, then D	0	8	0	3	0	0
Failure	0	0	0	3	0	28
Total	100	100	100	100	100	100

Note: Control Group: $6B^1$, 32 subjects; Experimental Group: $6A^1$, 32 subjects.

TABLE 42

Per Cents of Solutions Which Were:	C_1C_2		C_3C_4		#9	
	Control	Exp.	Control	Exp.	Control	Exp.
Only E	0	34	0	32	0	0
Only D	73	7	68	11	100	77
D, then E	23	48	31	45	0	0
1 E, then D	4	11	1	12	0	0
2 E's, then D	0	0	0	0	0	0
Failure	0	0	0	0	0	23
Total	100	100	100	100	100	100

Note: Control Group: $6A^4$, 22 subjects; Experimental Group: $6B^4$, 22 subjects.

TABLE 43

Per Cents of Solutions Which Were:	C_1C_2		C_3C_4		#9	
	Control	Exp.	Control	Exp.	Control	Exp.
Only E	0	48	0	45	0	0
Only D	51	2	57	0	100	48
D, then E	49	21	43	27	0	10
1 E, then D	0	17	0	19	0	0
2 E's, then D	0	10	0	7	0	0
3 E's, then D	0	0	0	2	0	0
Failure	0	2	0	0	0	42
Total	100	100	100	100	100	100

Note: Control Group: $6B^3$, 35 subjects; Experimental Group: $6A^3$, 21 subjects.

The E-Effects decreased somewhat but were still considerable. Every subject of the Control groups used the D method in the criticals, but from 1/4 to nearly 1/2 of the various experimental groups never gave a D solution to these problems, showing only variations of the E method. 100 per cent of every Control group solved Problem Nine, but again about 1/4 to nearly 1/2 of each experimental group failed the problem. In the three Control groups 93, 96, and 100 per cent of the subjects gave the D solution as their first answer in C_1C_2 (includes those who used only the D method); 41, 55, and 23 per cent of the experimental group subjects first gave the D solution. Some subjects in the experimental groups varied the E method externally; viz, $B - A - 2C$, $B - 2C - A$, $B - C - A - C$.

Experiment 4

The procedure of Experiment 3 was followed in a $5B^1$ class of 30 subjects but the test problems were changed to this set:

C_1	16	40	8	get 8
C_2	14	35	7	get 7
#9	26	64	13	get 13
C_3	12	30	6	get 6
C_4	10	25	5	get 5

so that each had many possible solutions; viz., C, $A - C$, $B - 2A$, $B - 4C$ (direct solutions), and in addition, $B - A - 2C$ (E solution) in the criticals.

Because of the varied kinds of responses and the small number of subjects in each category the results will not be presented in tabular form, but a general survey of the data will be presented.

Although the subjects reported that they did search for various solutions in

each test problem, a marked influence of the Einstellung was seen. The direct solutions were never used by some subjects, and in those cases where they were found, they usually came after one or more external variations of the E method. In C_1, for example, all 30 members of a class that served as a Control group gave a direct method first, and for 16 subjects this was the extreme direct method (filling the C jar, D′ method); only 12 of the 30 experimental group subjects gave one of the direct methods as their first solution, and in only 4 cases was this the D′ method. All in all, there were 54 direct solutions for C_1 in the Control group, each subject contributing from 1 to 4 such solutions; only 29 direct solutions were shown by the experimental group, at most 2 being made by any one individual, and 10 subjects not giving any direct responses whatsoever. The most direct solution, the D′ method, was used by 20 subjects in the Control group and only 5 subjects in the experimental group. No one in the Control group gave rewritings of the E method but 11 of the experimental group subjects gave from 2 to 4 such rewritings, as if they constituted different solutions. This picture was essentially unchanged in the subsequent criticals, even for those subjects who had succeeded in discovering a direct method in C_1; consistently, the direct solutions were about twice as frequent in the Control group, and in each critical approximately 1/3 of the experimental group, but no one of the Control group, gave various forms of the E method as different solutions.

The E-Effect was also large on Problem Nine: all 30 Control group subjects solved it, showing 49 solutions, of which 21 were the D′ answer; 11 of the experimental group subjects failed to solve it, 24 direct solutions were made in the latter group, of which only 7 were in the D′ manner.

Observations. The children usually stopped working after they had given one solution. We had to urge them on. In many cases the teacher had to reenforce our urging. "You have more time. Look for other ways to do the problems," they had to be told. It appeared to us that the children thought the task a very strange one—something they had rarely been asked to do. The comments of the subjects bear out this impression: "How were we supposed to find new ways to solve it when you had not taught us the new ways?"; "You teach one thing and expect us to do another"; "It's unfair"; "It's hard"; "I did the best I could do and, after all, my answer was correct"; "Why should I bother seeking new methods?"; "It's senseless to do the same thing many different ways."

Conclusion. It appears from these experiments that the search for different methods of solution was hindered by the tendency to use the E method and to view problems in the light of this method. The previous repetition of the E method in the E problems set a limitation upon some subjects' variability of response, causing them to fail to find other and simpler procedures which Control group subjects gave as their first answers.

SECTION 11

A. Generalize a Rule for the Problems

From the remarks of some subjects it appeared clear that they showed E-Effects because they assumed that the E method was the rule for the problems of the experiment. We therefore introduced this factor explicitly in experimental variations.

The class was told before the experi-

ment, "While solving the subsequent tasks, try to generalize or discover a method of solution or a *rule* to solve these problems." Fractionizing the results on the basis of the subject's answer to the question of whether or not he had generalized a method and what the method was, we found that those who had generalized the E method were in the majority (see Table 44); only 26 said that they had failed to find any general procedure. There was almost complete E-Effect for those who had generalized a rule, especially in the public school groups. Many of them either "solved" Problem Nine in the E manner or failed to solve it, regarding it as a problem which did not fit the rule. "The rule doesn't work here," they wrote, or "You made a mistake in this problem," or "The answer is 42 not 25," etc. When we consider the subjects in each group who said they had not discovered a rule, we find considerable E-Effect too; true, not so great as for those who did, but well within the range of E-Effects made by similar groups in the general experiment.

From these preliminary investigations, it seems that generalizing a method or a rule for the set of problems increases the possibility of Einstellung; of course, this does not say that E-Effects cannot result when the subject has not consciously generalized the E method.

TABLE 44

	Said They Generalized E Method				Said They Did Not Generalize or Find a Rule			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
College	22	100	91	86	0			
6B	33	100	100	100	7	79	71	71
6B	31	100	97	94	9	67	67	56
5B	23	100	100	100	10	80	80	70

B. The E Method Given as a Rule

The class, with the aid of the experimenter, formulated this rule after E_1 was presented: Fill the middle jar, and from it pour out twice into the jar to the right and once into the jar to the left. This was written on the blackboard and left there for the duration of the experiment. The subjects were told that it was *the rule* which solved the new type of problem they were learning today. In E_2 we aided those pupils who had difficulties; "remember the rule" usually sufficed. After E_2 the remaining problems were administered in the usual manner.

TABLE 45

	O's	C_1C_2	C_3C_4	#9
		E	E	F
$6B^1$	39	100	100	100
$6A^1$	43	100	100	100
$6B^3$	38	100	100	100
$6A^3$	41	100	98	98
$6B^3$	35	96	95	97
$6A^3$	36	96	92	97

As shown in Table 45, E-Effects were nearly 100 per cent in every instance, Practically every subject used the E method in the criticals, and about one-third of the subjects even treated Problem Nine in this way, writing $76 - 28 - 3 - 3 = 25$ or $76 - 28 - 3 - 3 = 42$. These are not very surprising results since the subjects were told that the E method applied

to the problems. What is interesting here is that this procedure was modeled after the lesson-plan usually followed, in the public schools in which we were experimenting, in presenting a new type of arithmetical problem. Such a method of teaching here resulted in automatic repetition, by almost every child, of the E method. Perhaps some of the Einstellung Effects found in the general experiment may be traced to the influence of this kind of teaching procedure (note hypothesis V C, page 30). Comments made by some subjects in the general experiment indicate that they viewed it as a teaching situation, and therefore took it for granted that all the problems must be alike, and that their task was to repeat the same method. Thus, E-Effects may have been a result in some instances of imputing to the experiment an attitude developed by the method of teaching used in the school.

C. The E Method as a Rule and Only One E Problem

Experiment 1

Is a rule plus one E problem equivalent to several E tasks in succession? In other words, is the assuming of the E method as a rule equivalent in its results to becoming mechanized by repetition? It seems so. After three sixth year classes had been taught the rule as in the previous experiment of par. B, we did not proceed with E_2 but began to present the criticals. The E-Effects were smaller than in par. B but were as large as in the general experiment. It would seem that the act of assuming a rule can take the place of repetitions of the E method. (See Table 46.)

Experiment 2

The effect of a rule was tested in another variation. A sixth year public school class of 40 subjects received the usual experiment through E_1. Then they received C_1 followed by E_4, in which the method of writing the answer was again shown, as in E_1, and in addition they were told, "This is the rule for this type of problem." Then, at intervals of 2½ minutes C_3, C_4, #9, C_1, C_2 were presented, in that order. In this experiment we can see the effect in the same class of one E problem with no rule and one E problem plus a rule. We can also compare the solution of the same critical (C_1) before and after the rule.

TABLE 46

	O's	C_1C_2	C_3C_4	#9
		E	E	F
6B	45	87	87	73
6B	37	96	93	78
6B	41	100	100	85

1) After the first E problem only 5 subjects developed an Einstellung; i.e., solved C_1 by the E procedure.[43] In the test problems following E_4 plus the rule they again showed Einstellung—all five solved the criticals in the E manner and failed Problem Nine.

2) The remaining 35 subjects, who had not developed an Einstellung after

[43] This result is in contradiction to that of experiments on pages 39 to 42 where after one E problem the E-Effect was as large as in the general experiment. We have not had sufficient experience with experiments in which one E problem preceded the criticals, but we have the impression, based on a number of individually conducted experiments, that the range under these conditions is very much larger than in the general experiment where five E problems came before the criticals. The situation is much more labile, attitudinal factors play a very large role. One may with such a set-up, one E before the criticals, obtain no E responses at all in the latter problems or E responses in each one of them. In the simplest case, the one result or the other will be obtained depending on whether the subject or group of subjects believes or does not believe that the problems subsequent to the one E problem are intended for application of the method used there (cf. page 44).

one E problem, did show, after E_4 plus the rule, E-Effects as large as in the general experiment.

3) The 35 subjects who had 0 per cent E of C_1 at first, gave 61 per cent E solutions of it after the rule.

4) The results of the class, as a whole, are shown in Table 47.

TABLE 47

	E′		C_1	E_4+rule		C_3	C_4	#9	C_2	C_1
O's	E	F	E	E	F	E	E	F	E	E
40	97	3	13	62	38	80	73	65	75	67

Experiment 3

In another variation we did not actually tell the subjects that they were learning a rule of solution, but we gave them E_1 five times "So that you will learn the solution well." This was said with each presentation of E_1. We then presented the test problems, omitting the remaining E tasks. E-Effects as large as those of the general experiment resulted. After the experiment we asked the subjects to indicate their reaction to the repetition of the same problem. They said they thought they were learning a rule or formula or practicing a method to be used later. Their results are shown in Table 48.

TABLE 48

	O's	C_1C_2	C_3C_4	#9
		E	E	F
6B	36	75	75	64
6B	41	89	78	68

Experiment 4

In still another variation the subjects were given E_1 five times without any explanation at all. After the usual introductory and illustrative remarks of the general experiment, we presented E_1 for the first time and told a 5A class of 30 children that they must refrain from calling out, and that they should do each example as given to them. Every time we presented E_1 as the "next example" there were visible astonishment and chagrin on the faces of the children, and some wrote after the example, "Why are you repeating it?" When C_1 was presented there were "gasps of joy." They seemed to attack the problem with zeal. The E-Effect was large, in fact, it was similar to the per cent obtained in the general experiments,

C_1C_2: 75% E C_3C_4: 65% E #9: 63% F.

After the experiment the children were told, "Suppose you met a friend and he asked you about this test saying, 'I heard that you were given a funny kind of test. The teacher repeated the same example five times. Why did he do it?' What would you tell him? What reason would you give for being given one example five times?" The answers which the children wrote to this question fall into the following types:

1) To make them get the idea of the example; to make them learn or understand or memorize it well.

2) To see that they did not forget it.

3) To see if they could get it right.

4) To make sure that they knew it.

5) Because it was hard and not done by some children.

6) To see if they could do it more quickly.

7) To be patient and do it without making a fuss.

8) To be prepared for it in some future test; e.g., midterm examination.

9) To learn a rule or method or idea that will aid in future problems.

10) Three children said that they did not know why it was done.

In a college class of 29 subjects the E-Effects obtained were considerable but less than in similar groups of the general experiment,

C_1C_2: 52% E C_3C_4: 28% E #9: 17% F.

In answer to our questioning the subjects said that they were waiting for something to happen, the repetition bored them, they sought reasons for the repetition, tried to guess a rule, thought that we wanted to see whether they would vary their answer.

Experiment 5

We varied the above procedure by telling a 5B group of 36 children that they should repeat the problem. Instead of introducing each repetition as a new problem, we said "Now, please do it again." Again we had protesting and revolting actions; but, somewhat fewer than before. The results, however, are essentially the same for E-Effect: 75 per cent E solution of C_1C_2 and 72 per cent failure of Problem Nine. There was less recovery than before, 4 per cent increase of D solutions in C_3C_4. The comments were similar to those of the 5A group. The results found in these three classes and the protocols of the subjects constitute evidence for hypotheses III, page 29, and V C, page 30.

Conclusions. E-Effects were increased when the subjects generalized a procedure in the E problems or were given or taught the E method as the rule which applied to the problems.

The use of one E problem as the illustration of a rule sufficed to produce E-Effects as large as or greater than those obtained by giving the usual set-up with five E tasks. Subjects who had shown no Einstellung in a critical gave 61 per cent E solution of it after one E problem plus a rule.

Having the subjects repeat the E method five times in the same E problem in order to "learn it well" resulted in large E-Effects, in spite of no other E problems being given. When E_1 was presented five times without any explanation for the repetition, subjects gave large E-Effect and showed the influence of factors described in hypothesis V C, page 30, in their interpretation of why the same problem was repeated.

In these experiments we have seen that E-Effects need not necessarily be viewed as a result of a kind of inertia brought about by repetition, as mechanical perseveration of what was done before; but can be viewed as the outcome of "reasonable" behavior, generalizing a rule, inferring a method (hypothesis III A, B, D, page 29). (Of course, these experiments do not rule out the possibility of Einstellung Effect being produced by non-intelligent behavior.) Hypothesis V C, page 30, may be taken as a possible explanation for such "reasonable" use of the E method.

SECTION 12

If the "obviousness" of the direct method is increased radically—the required amount of water obtainable by just filling one of the given jars—will the E-Effects vanish?

A. Critical Test Problem with Extreme Direct Solution

Experiment 1

When such a problem, 3, 64, 29, get 3, henceforth designated by C′, was pre-

sented to a class of college students without the preceding E problems, they all solved it by filling the 3 quart jar; when it was given to other classes immediately after the five E problems and before C_1 C_2, #9, C_3, C_4, there were many subjects in each class who solved this problem, not by filling the 3 quart jar (D′ method), but by the circuitous $B - A - 2C$ method. That the E-Effects did not disappear is clearly seen in the following table.[44] The E-Effect in C′ was very strong.

It should be noted (Table 49) that in two of the classes, second and fifth, a smaller per cent of the subjects were blind to the direct method in the C′ problem, than was the case in similar classes in the general experiment where the direct method was not so obvious.

One college group of 75 subjects not shown in the above table gave only 32 per cent E solution of C′, but we have to remark that when C′ was presented there was loud laughter and a shout of, "Why! the answer is right here!"—Still, 32 per cent reacted in the E way. (Cf. Clarification Experiments, pages 77 to 82.)

The procedure of Experiment 1 was used in four public school classes.

TABLE 49

			C′	C_1C_2	C_3C_4	#9
		O's	E	E	E	F
Control-Coll. Jr.		20	0	0	0	0
Day	Coll. Jr. 1	24	82	88	65	58
Eve.	Coll. Jr. 1	21	52	59	40	33
Eve.	Coll. Jr. 2	22	80	73	45	45
	H.S. A.	27	59	81	54	75
	H.S. B.	20	85	95	80	41

E solutions of C′, though of a wide range—between 44 and 100—lie within the range of E solutions to C_1C_2 found in the general experiment with corresponding classes.

TABLE 50

	Plain						DBB				
			C′	C_1C_2	C_3C_4	#9		C′	C_1C_2	C_3C_4	#9
	O's	E	D	E	E	F	O's	E	E	E	F
Control-6B	32	0	100	0	0	0					
5A	16	44	56	40	47	37	17	53	53	53	53
5B	23	74	26	67	74	87	18	75	75	67	55
6A	13	100	0	02	96	92	17	82	82	88	53
6B	18	100	0	89	100	78	14	100	100	89	93

Experiment 2

In other experiments seven problems, all solvable by an E method ($B - A - C$ method), were followed by a critical test problem solvable by filling one of the jars (D′ method) or by the $B - A - C$ method; see page 94. In an adult group of 31 subjects there were 74 per cent E solutions, and in a public school group of 35 subjects, 77 per cent E solutions of

[44] In the table are presented the responses to all the criticals and to Problem Nine, although we are here concerned mainly with C′.

such a problem. This problem alone had been presented to each class eight days before—without the preceding E tasks—and 100 per cent of the subjects then had used the direct method. (Cf. page 76.)

It may be asked, "Is there not the possibility that the subjects saw the D′ method but thought they had to use all three jars or thought that a solution involving only one jar was too simple to be acceptable?" (Cf. hypothesis III, page 29.) These considerations are not borne out by the comments of the subjects who failed to employ the D′ method. On being shown this solution nearly all of these subjects regretted that they had not previously seen it, and many of them bewailed their blindness and stupidity. Moreover, it was possible to proceed here with an experimental change.

Experiment 3

In one public school class the 30 subjects were told, beginning with C′, "Using one, two, or three of these jars, get the required volume of water," and still there was a great number of E solutions of C′, 80 per cent. (See page 62 for a description of similar experiments.)

B. Problem Solvable by Extreme Direct Method but Not by E Method

Experiment 1

In all of these experiments the E method did solve the C′ problem; let us present a task solvable by the filling of one jar but not by the E method. Such a problem, 3, 65, 29, get 3 quarts of water, was substituted for the usual Problem Nine in two public school classes and one college class of sophomores. (See Table 51.) Each group had subjects who did not use the simple D′ procedure and thus failed the problem.

Thirty per cent of the college students devised a most ingenious solution to this new problem: $65 - 29 = 36 - (11 \times 3) = 3$. In "eleven times three" they employed the 3 quart jar but they did not give the simple D′ solution.

TABLE 51

	O's	C_1C_2	C_3C_4	C′ (as #9)
		E	E	F
$4B^3$	28	82	76	74
$6A^3$	33	76	67	58
Coll.	20	90	73	40

Experiment 2

To avoid the possibility of this other method, we changed the problem to 4, 67, 17, get 4, and presented the experiment with this problem in place of the usual Problem Nine to a class of 24 college sophomores. Sixty-two per cent of the subjects failed to solve the problem.

Experiment 3

In the immediately preceding experiments the C′ example which could not be solved by the E method was substituted as a kind of problem similar to Problem Nine of the usual experiment. How would it be treated if it were presented immediately after the E tasks? This was done in a class of 32 public school children, and 15 of them failed to solve the problem, whereas when a similar class of 39 pupils was given C′ alone, every subject solved it.

SECTION 13

Introduction—Previous Experience with Some or All of the Problems

What happens if a group which has participated in the whole general experiment is afterwards given the entire experiment again with or without a time

interval? One might expect that the results would be about the same, those subjects who had not recovered in the first presentation using the E method again, and only those who had experienced recovery showing a decrease in E-Effect.

It is also possible to think that giving the set a second time—or giving only the criticals again—would offer an occasion to the subject for improvement: for grasping the idea that a less mechanized response is possible, for catching on to the "trick" in the experiment, for becoming clear about the ambiguity in the criticals.

Experiment 1

Two months later we administered the experiment again to the entire fifth year of P.S.A (of the general experiment).

Repeating the experiment produced only a slight improvement in the test problems. (See Table 52.)

At the close of the experimental session the subjects were asked whether they had noticed any familiarity to the experiment in which they had participated two months before. The answers indicated that few or none were aware that it was the exact repetition of the same problems. A number of subjects reported being somewhat more at ease the second time.

Experiment 2

Would the E-Effect decrease if the second presentation immediately followed the first? Directly after the completion of the experiment in a $5B^1$ class (see Table 53), new papers were distributed and all the problems again written on the blackboard, one at a time. The subjects worked more rapidly than before.

Their E-Effects the second time were similar to those made before, except for an *increase* in the number of failures of Problem Nine.

Our questioning revealed that some subjects were aware that the same problems were being repeated, and thought that because the teacher had not liked their work or their lack of speed on the first "test," they were being given another chance. Others did not recognize that the two sets of problems were identical; they thought they were getting additional practice on a similar type of problem.

TABLE 52

	Plain				DBB		
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
1st Time	45	85	86	87	38	88	92	87
2nd Time	45	82	82	80	38	80	80	79

TABLE 53

	O's	C_1C_2	C_3C_4	#9
		E	E	F
1st Time	27	87	83	66
2nd Time	27	89	83	74

Experiment 3

In a college class of 21 juniors and seniors the experiment was presented again immediately after the first administration was completed. (See Table 54.)

There was some decrease in E-Effect the second time.

At the first presentation, four subjects had recovered in C_3C_4. The second time, three of the four used the D method in all the test problems; one used the E method. The three claimed that throughout the second session they were on the lookout not to fall into a mental rut, as they realized they had done before. not recover but set himself the task to look anew at the problems improved in the second set.

TABLE 54

	O's	C_1C_2	C_3C_4	#9
		E	E	F
1st Time	21	86	64	62
2nd Time	21	62	59	57

Experiment 4

Will there be less E-Effect on C_1,C_2, #9 if these problems alone, without the E tasks, are given again after the usual experiment?

After the completion of the general experiment, papers were collected, new ones distributed, and C_1, C_2, #9, again presented, one at a time. (Table 55.)

When C_1,C_2, #9 were administered again, two groups, the third and the fifth, showed a considerable decrease in E-Effect; in the other classes there was little improvement.

TABLE 55

Class	O's	1st Presentation			2nd Presentation	
		C_1C_2	C_3C_4	#9	C_1C_2	#9
		E	E	F	E	F
$4B^1$	18	81	78	57	78	72
$5A^3$	17	79	76	71	74	64
$5A^1$	12	88	75	75	54	42
$6B^1$	27	72	69	63	70	56
$6B^3$	18	78	72	50	64	28

Among those who had used the E method in all the test problems when they were initially presented, there was one subject who later solved all the test problems in the D way. He reported suspecting some reason for the repetition of the experiment; he looked carefully at each problem to see what he could do that he had not done before. The others believed that the problems were being repeated in order to test the speed at which they now would solve them. Many subjects saw no sense to the second presentation and thought it stupid of the experimenter to give "such easy examples" twice.

Repeating the experiment seemed to help only those subjects who had recovered before in C_3C_4. The one who did

At the first presentation, only four subjects had recovered in C_3C_4, one in each of the first, third, fourth, and fifth groups. The second time C_1, C_2, #9 were given, three of the four solved them in the D manner, one used the E method in C_1C_2 but solved Problem Nine directly.

It would be of interest to know the results made, in the subsequent presentation, by those subjects who showed E-Effect in all the test problems when they were first presented, who therefore had had 100 per cent E in C_1C_2 and 100 per cent failure of Problem Nine. Their responses, the second time are shown in Table 56.

In some classes these subjects showed improvement; in others, they did not, still making 100 per cent E solution of

TABLE 56

Class	O's	C_1C_2	#9
		E	F
$4B^1$	12	100	100
$5A^3$	9	78	78
$5A^1$	7	57	57
$6B^1$	14	100	100
$6B^3$	5	80	60

C_1C_2 and 100 per cent failure of Problem Nine.

Experiment 5

What would happen if we employed the following technique? In order to help the subject see the light in the general experiment we give some or all of the test problems before the usual experiment is administered. The class thereby serves as a Control group first and then as an experimental group. If the subjects first solve the test problems in the D way, will this make for little or no E-Effect when the identical test problems are given in the general set, thus working against the effect of the E tasks and achieving the goal set forth in the introduction to these experiments (page 74)?

Two public school classes received problems C_1 through C_4; they showed 100 per cent D solutions. Two months later, they received the usual experimental set-up, with the results shown in Table 57.

TABLE 57

Class	O's	C_1C_2	C_3C_4	#9
		E	E	F
5B	38	75	69	69
6A	39	82	82	70

In spite of having previously solved the test problems in the D way, the group did not have less E-Effect in the general set than had corresponding groups participating in the general experiment.

Experiment 6

Perhaps the above described procedure would be more effective if we shortened the time interval between the presentation of the test problems alone and the presentation of the entire set-up.

Immediately after C_1, C_2, and #9 had been given, all the problems of the usual experiment were administered. The results are shown in Table 58.

TABLE 58

Class	O's	C_1C_2	C_3C_4	#9
		E	E	F
Day Coll.	60	72	25	37
Eve. Coll. A	16	78	31	56
Eve. Coll. B	15	83	43	67
H.S. A.	23	83	63	74
H.S. B.	27	67	44	38
$5B^3$	13	50	62	61
$6B^3$	30	73	67	67

In a high school lecture group of 65 subjects, the results of which are not included in the table, a subject cried out on the second presentation of C_1, "You gave this before." The class laughed. The whole atmosphere changed. Exclamations of "Oh! I see now," "I see the trick," "Ah! So that's it!" came from all sides of the room. This group showed in the general set 34 per cent E of C_1C_2, 15 per cent E of C_3C_4, and 8 per cent failure of Problem Nine.

We see that having previously solved some of the test problems in the D manner generally did not prevent one from showing E-Effect in these very problems when they followed the E tasks. Some of the groups showed a little improvement

in C_3C_4, others in Problem Nine. In the last mentioned group there was a strong decrease in E-Effect; this clearly was brought about by the effect, on the class, of the remark made by one pupil. The one remark sufficed to bring clarification to many about the "trick" in the experimental set-up.

Does the introduction of clarification generally annul Einstellung? We attempted to bring about clarification in several ways. We shall see the results in the following experiments.

A. Clarification Before the Experiment

Would the E-Effect disappear if the subjects were told before the experiment about the ambiguous nature of the test problems?

Experiment 1

The grocery store introduction as used in the general experiment in public schools was given, but then we added:

1. "If you had as measures 4, 28, 6 quart jars, how would you obtain 10 quarts of water?" Answer of class: $4 + 6 = 10$.

2. "Yesterday, in another school, the children did it in this manner: $28 - 6 - 4 - 4 - 4 = 10$. Which of the methods do you prefer? Why?"

3. "Can you guess why the children in yesterday's class used this roundabout method?"

4. "Before they were given the example I gave you, they solved examples similar to this one, 5, 57, 20, get 22, which they did in this manner: $57 - 20 - 5 - 5 - 5 = 22$. And they used this same method in the example I just gave you." The class was shown the similarity.

5. "Yesterday's children called themselves stupid, dumb, and blind when I showed them the more direct method. They said that they had stopped thinking, that they had not bothered to examine each example but merely repeated what they had done before."

6. "What is the moral of this experience?" (We waited for the class to answer.) "In solving an example, you must examine it first, not just repeat, like a machine, what you did before. Face each example, see what has to be done, and do it in the most direct way. Of course, after examining an example carefully you may see no other alternative but to repeat what you did before. In such cases you'll have to repeat. However, if you are awake, looking at the example, and thinking, you will find examples which can be solved in a more direct way."

7. "Now I am going to see how well you can keep your eyes open and do examples in the most direct way instead of just mechanically repeating what you did before. Look at each example to see what needs to be done and can be done directly. Don't be blind or stupid; don't fall into the same trap that yesterday's children did."

After the above introduction which took from 8 to 12 minutes, the usual problems of the general experiment were presented. The results, see Table 59, showed that the clarification before the experiment was effective for many subjects: we got considerably less E-Effects than in the general experiment in which there was no previous clarification of such kind. Some subjects, however, it did not help.

TABLE 59

	O's	C_1C_2	C_3C_4	#9
		E	E	F
$5A^3$	26	40	35	23
$5B^3$	30	35	37	27

Not included in the table are 2 subjects in $5A^3$ and 5 subjects in $5B^3$ who

gave an $A + 2C$ solution in E_5, a solution rarely made in the general experiment. All 7 subjects solved the criticals and Problem Nine in the direct way. Only 7 subjects in $5A^3$ and 8 subjects in $5B^3$ used the E method in both C_1 and C_2. The per cents given in the table include also cases of E in either C_1 or C_2, C_3 or C_4.

Observations. The class worked quietly on the E problems; there were subjects who took 2½ minutes for each; very few appeared to hurry. When C_1 was presented, spontaneous, gasp-like expressions and smiles appeared on the children's faces. Answers to the criticals were usually given in less than 1 minute; one half of the class finished within ½ minute; and there were several instantaneous responses to each of the criticals. It seemed that only those who gave E solutions took more time.

From the beginning many of the children appeared not to have a tendency to repeat the E method—they were "on the look-out" for the easiest way to solve each problem, as many of them wrote in their comments.

We questioned those who had given some E solutions in the criticals. They said that they had forgotten to look at each problem, thought that they must subtract, never thought of addition, etc.

The teachers pointed out that most of the children who had used the E method in the criticals were now taking remedial arithmetic where isolated drill is used, that in class they can do only what they have just been drilled in, and fail at anything new.

Experiment 2

In order to increase the effect of the clarification we gave a $6A^1$ class of 36 pupils the previously described "clarification" (page 77) before the experiment, along with the following instruction: "After the sixth example write the words, 'Don't be blind' on your paper. This is to remind you to be especially careful in all of the coming examples, to keep your eyes open so that you won't fall into the trap, make some foolish mistake, or give a dumb answer to the example." The class was asked whether they understood what they were to do and when to do it. When all stated that they did understand, the usual experiment was administered. Again comparatively little E-Effect resulted, even somewhat less than in the previous Experiment 1.

$6A^1$ 32 O's C_1C_2: 22% E C_3C_4: 22% E #9: 9% F.

The results do not include 4 subjects who gave the $A + 2C$ method in E_5. All of these 4 gave D solutions in C_1C_2, #9, C_3C_4. Only 2 of the 32 subjects used the E method in both C_1 and C_2. The per cents in the preceding table include also cases of E in either C_1 or C_2, C_3 or C_4.

Observations. As in the previous experiment, there was little hurrying in the E problems. Beginning with C_1 there was brightening up of faces, and almost the entire class finished this problem within 1 minute. There were more than 10 instantaneous responses to each critical. All but 5 subjects finished Problem Nine within ¾ of a minute.

The teacher went over the responses with the experimenter. She said that those who gave E solutions were taking remedial arithmetic. (Not all the 17 who took remedial arithmetic developed an Einstellung, but all who developed an Einstellung took remedial arithmetic.) She told that in this remedial training children are drilled in one kind of example until they pass the test on it; then they are drilled on another kind until

they pass the test on that, etc. Her complaint was the same as that made by the $5A^3$ and $5B^3$ teachers: these children can solve only that which they have practiced immediately before; they can not think an example through; they fail at anything a little bit new.

As in the previously-described experiment, the attitude of the subject and the method of teaching that he was accustomed to seemed to affect the efficacy of the clarification.

Experiment 3

We selected a class in which all but 8 pupils had been given remedial work of such kind in arithmetic last term. This class was in the same school and on the same grade level as the previously-used $6A^1$ class (of Experiment 2) and had a similar I.Q. range and average. The technique used was that of Experiment 2.

$6A^3$ 23 O's C_1C_2: 52% E C_3C_4: 46% E #9: 39% F.

Not included in the results are 3 subjects who gave an A + 2C solution for E_5. One of these 3 had not had remedial training; he had D solutions in C_1C_2, #9, C_3C_4. Two had had remedial training; of these, one gave E solutions in both C_1 and C_2, and the other gave E in C_1.

Nine of the 23 subjects gave E solutions in all of C_1C_2, #9, C_3C_4; all 9 had had remedial training. Every pupil who had had remedial training gave some E solutions. Of the 8 pupils who had not had the remedial work, only 2 gave any E solutions.

Observations. There was less of the insightful behavior when C_1 was presented and fewer spontaneous smiles and gasps than in the previous classes. Quick, instantaneous responses in the test problems were rare, but quick responses in the E problems were frequent.

Although the results are better than in 6A groups of the general experiment, there is more E-Effect than in the clarification classes which were not told to watch out after the sixth problem (Experiment 1) and far more Einstellung than in the warned $6A^1$ class. (Experiment 2).

We must be cautious in drawing conclusions. We may be seeing here not so much the effect of the kind of remedial training as the effect on the Einstellung of subjects who are poor in arithmetic. Furthermore, the experiment was conducted after the class had had an hour's work in fractions; it may well be that they were tired of arithmetic. The attitude was more tense than in $6A^1$ All these considerations makes comparison difficult.

Experiment 4

In a group of college upper classmen the procedure followed was the same as that of Experiment 1 (page 77), except that one half of the class (DBB group) had been told before any other instructions were given, "After the sixth problem write the words 'Don't be blind' on your paper. This is to remind you to watch out, to be careful, or you will make a foolish error." There was less E-Effect in the Plain group than in college classes of the general experiment, and no E-Effect whatsoever in the DBB group.

Plain Group

15 O's C_1C_2: 10% E C_3C_4: 0% E #9: 7% F

DBB Group

12 O's C_1C_2: 0% E C_3C_4: 0% E #9: 0% F

Experiment 5

The E-Effect decreased if before the experiment the subjects were warned of the possibility of being blinded. Would it still decrease if, along with giving the clarification, we shortened the time al-

lotment per problem; i.e., introduced a condition of speed? (See "Speed Experiments," page 53.) In a college junior class the procedure of Experiment 4 was followed, but after the clarification and before any problems were presented, the class was told, "You will be given 30 seconds per problem. The goal is to solve as many problems as possible."

Plain Group

11 O's C_1C_2: 55% E C_3C_4: 55%E #9: 55% F

DBB Group

11 O's C_1C_2: 27% E C_3C_4: 18% E #9: 18% F

It is interesting to note that only 11 of the 19 Plain group subjects and 11 of the 15 DBB subjects solved at least E_4, E_5, whereas in the general experiment almost all college students solved these problems. The E-Effects are smaller than those obtained with college junior groups in the general experiment but far larger than in Experiment 4. Because of the introduction, the subjects reported, they realized that they should watch out for tricky, easy problems, but were unable to do so because of their haste and tension. Having to seek new procedures, they said, even though they knew they should, was difficult with the time limit imposed on them.

Experiment 6

What would be the effect on the Einstellung if we gave the clarification as in Experiments 1 through 4 Plain, but increased the number of E problems to ten? (See "More E Problems Experiments," pages 38 to 39.) This was done in a class of college juniors, and the resulting E-Effects were greater than those in Experiment 4 and approximated those of the general experiment.

21 O's C_1C_2: 69% E C_3C_4: 59% E #9: 55% F

Comments indicate that many subjects tired of examining each problem to see if it had another solution, that after a while they thought the introduction a jest and believed that problems having a simpler method of solution would never be given (hypothesis III, page 29).

B. Clarification After the Experiment

Experiment 1

In pages 73 to 77 we reported on experiments in which after the usual series of problems had been presented, the subjects were again given the entire experiment or only some of the criticals. In the classes where we presented for the second time only the criticals (Experiment 4), we continued the experiment by introducing factors which we hoped would produce 0 per cent E-Effect.

After they had solved C^1,C_2, #9, for the second time, we asked the class to put down their pencils and listen to a story. They were told of a maze experiment to develop Einstellung in rats and asked to predict the outcome. Nearly all predicted E responses and gave "habit" as a reason. When they heard that the rats did not develop an Einstellung, they commented on the rats' cleverness and wide-awakeness. They were told to examine their own solutions of C^1,C_2, #9, which we then discussed. Soon there

TABLE 60

	O's	Plain	
		CC_4	#9
		E	F
$4B^1$	12	13	8
$5A^3$	9	0	0
$5A^1$	7	0	0
$6B^1$	14	28	7
$6B^3$	5	0	0

came cries of "How dumb of me"; "How blind of me"; "How silly I was"; "The rats are cleverer than us." We told them to turn over their papers, and we presented C_3C_4 and a problem similar to

Problem Nine. The subjects who had initially shown complete E-Effect now gave the results shown in Table 60.

The understanding gained from the discussion, that the problems can be solved in two ways, one simpler and the other more difficult, brought about complete recovery in three of the groups and large decreases in E-Effect in the other two.

Experiment 2

We have seen that repetition of all or some of the problems after the experiment did not weaken the Einstellung (see page 77), but that a discussion after the experiment produced recovery in the second presentation of the criticals. Would there then be a decrease in E-Effect if at the completion of the usual set-up, we held a discussion about the experiment and, after this, repeated the experiment?

a. A college class finished the usual experiment, and a discussion ensued in which the subjects were told that the test problems could be solved in a direct manner and were made aware of the dangers of becoming habituated in the E problems. Now the same experiment was repeated. Did the subjects still overlook the D method? No. (See Table 61.)

b. In a similar college class we gave, after the discussion, a set of tasks similar to the usual one with regard to the number of E and test problems, and the E and D solutions required (E method = $B - A - 2C$; D methods = $A + C$, $A - C$), but in which the actual problems were changed (see page 94 for problems). The E-Effect disappeared almost completely. (See Table 62.)

c. Still another college class received, after the discussion, a new set of E and test problems with new E and D methods (see page 94 for problems). The E method was $A + B - 4C$, the D method $B - A - C$, and the directions changed to include the instruction that all three jars must be used as measures. Yet there was a marked decrease in E-Effect. (See Table 63.)

d. Two months elapsed between the discussion and the second presentation of the problems of the general experiment

TABLE 61

		Plain				DBB		
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	17	71	56	53	12	67	50	42
After	17	0	0	0	12	0	0	0

TABLE 62

		Plain				DBB		
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	16	75	63	56	17	62	53	41
After	16	6	0	0	17	0	0	0

TABLE 63

	Plain				DBB		
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	10	75	65	60	11	64	45	45
After	10	35	0	0	11	0	0	0

TABLE 64

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	12	75	58	67	18	58	41	44
After	12	4	0	8	18	0	0	0

to a college class, but again there was a great decrease in E-Effect. (See Table 64.)

e. Even when two months after the discussion we used, in still another college class, a different set of problems involving different E and D solutions, E: $B - 4C - A$, D: $A - 2C$, $A + 2C$ (see page 94 for problems), the decrease, though not so thorough, was quite pronounced. (See Table 65.)

Experiment 3

In two college classes, instead of a complete discussion after the general experiment, only the results were made known and the general plan of the set-up clearly but shortly presented.

a. One month later, the usual experiment was again given to one class. (See Table 66.)

b. Two months later, the usual experiment was again administered to the other class. (See Table 67.)

This procedure was not sufficiently thorough in all cases. Quite a number of subjects, surprisingly enough, particu-

TABLE 65

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	10	80	65	60	11	63	43	36
After	10	30	0	20	11	0	0	0

TABLE 66

	Plain				DBB			
	O's	C_1C_2	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	9	83	67	78	14	64	50	50
After	9	56	39	44	14	29	7	36

larly in the one month interval class, showed the E-Effect in spite of the previous discussion.

Conclusion. It seems clear that if the structure and purpose of the experiment are grasped and if they are not forgotten, in the new performance there is little or no E-Effect, results which argue against hypothesis I (page 28). We have to add, however, that although we obtained in this way 100 per cent D solutions in some of the groups, the matter is not fully settled. What would happen if in the second experiment conditions were made more favorable to Einstellung behavior; e.g., if more than five E tasks were given or speed factors introduced? It may be that in such cases mechanization would result even though the subjects were clear about the experiment. Preliminary individual experiments testify to this.

The general experiment was administered, a complete discussion of it ensued, and then the experiment was readministered, but this time eight E problems were given. E-Effects approximating those of the general experiment were obtained. Some subjects expected the D method to work in Problem Six, and seeing that it did not apply here nor in Problems Seven and Eight, they began to doubt that there were criticals, often asking, "Where are those trick problems?" (Cf. hypothesis III, page 29.) Others said that after a while all they could think of was the E solution, it became natural to them and difficult to see anything else.

In some cases, after the usual experiment had been administered and thoroughly discussed, it was readministered as a "speed test." Some subjects told that the stress on time gave them so little chance to think that without realizing it, they again developed an Einstellung; others said they soon found the E solution to be the best way of dealing with the problems, still others said that the desire to get finished became paramount and they either neglected to see the D method or on seeing the E solution at first glance, utilized it.

TABLE 67

	Plain				DBB			
	O's	C_1C_7	C_3C_4	#9	O's	C_1C_2	C_3C_4	#9
		E	E	F		E	E	F
Before	17	71	62	61	17	56	41	41
After	17	12	6	6	17	12	0	6

These latter experiments show that it is possible to mechanize a subject who knows about the experiment, to bring an informed subject to a habituated performance. This should in no way be taken as proof of a general tendency toward mechanization. Let us not proceed too quickly with generalizations, with assuming a fundamental and universal mechanism for conditioning. At the present state of affairs we have to formulate: There are conditions under which men act mechanically. This has been shown. There are other conditions under which there is not the slightest tendency to do so.

SECTION 14

That in the general experiment the E method of solution was illustrated by the experimenter, and not the D method, may have focused the subject on the E procedure, facilitated certain assumptions about the experiment (hypothesis III, page 28) through the possible pres-

tige of the experimenter. We tested this in the following experiments.

A. No Illustration of the E Solution

In four classes, in neither the illustrative problem nor in E_1 was any solution shown; instead, 3 and 4 minutes each, respectively, were allotted to these two problems, and the remaining problems presented in the usual 2½ minute time allotment. The responses of a number of subjects in each group had to be discarded because they did not solve E_4,E_5, a result probably due to lack of instruction (10 in College A, 1 in College B, 9 in the high school class, and 17 in the P.S. 5A group). But as far as the remaining subjects are concerned, the picture with regard to E-Effect was essentially the same in these groups as in comparable groups of the general experiment (with the exception of a somewhat smaller per cent failure of Problem Nine in the high school group). The college groups had less E of C_3C_4 than usual, indicating better experimental extinction.

TABLE 68

	O's	C_1C_2	C_3C_4	#9
		E	E	F
Coll. A	12	91	44	38
Coll. B	16	83	25	50
H.S.	20	95	80	41
P.S. 5A	10	90	90	80

B. Other Experimenters and Non-Classroom Situations

The experiment was administered by the writer to his friends and his acquaintances; it was presented as a game at gatherings both by the writer (who as far as he can tell was known here only as a poor dancer), and by other persons; it was conducted by high school boys (none of them leaders or outstanding boys) in school clubs and outside of school, with other high school boys serving as subjects; it was given by teachers to groups of teachers; it was administered by a known "red-baiter" to a group of liberal students; by a disliked "radical" to members of conservative political and religious organizations. The results as to E-Effects were in all these experiments as great as in similar groups in the general experiment.

SECTION 15[45]

The Problems Do Not (Apparently) Come from the Experimenter

Experiment 1

The E-Effect may be attributed to a certain kind of confidence—confidence that the experimenter is a well-meaning individual who will not fool them by giving problems that look alike but are solved by different methods; confidence that a set of similar appearing problems, all coming from the same individual, must all be solved by the same method (hypothesis V A, page 30). (Such beliefs show already the working of a learned attitude which we can trace perhaps to life, and particularly to school situations.) But experiments already reported in which a disliked or even hated person was the experimenter indicate that trust and confidence in the latter are not essential for the E-Effect. It was also possible to study the development of Einstellung when the problems did not (apparently) stem from the same person, and subjects had little reason to be confident that they would all be solvable by the same method. This procedure rules out a number of the factors mentioned in hypothesis III, page 30.

A class of adults was shown a problem

[45] This section is related to par. 16 in the Survey of Results presented on page 37. There are no experiments corresponding to par. 15 of the Survey.

in which a certain amount of water had to be obtained by using as measures two jars. Then they were asked by the writer (their instructor) to try, during the coming Christmas holidays, to devise problems in which a certain volume of water was to be obtained by means of three given jars. On the first day of class we collected the problems they made and told them that we would try out some of them. After distributing paper, we selected at random eleven sheets of contributory problems and feigning to read each problem from the sheet, we presented our usual problems in the usual manner, save that we did not stop to illustrate any method and gave 4 minutes for E_1.

Yet the E-Effect was as large as in similar adult groups of the general experiment,

17 O's C_1C_2: 76% E C_3C_4: 65% E #9: 59% F.

At first view, the results of this experiment seem a clear decision pro hypotheses I and II (conditioned through mechanization) and a powerful decision against hypothesis III (reasonable induction), because with the apparent random conditions of the experiment, the reasonable basis for the assumption was removed. The matter, however, is not so simply settled. It may be that the material uniformity of succession of the problems E_1, E_2, E_3, E_4, E_5 testified against the random nature. This may have been accomplished in various ways; for example, the subject, impressed by the uniformity, and not for the moment thinking about the supposedly diversified sources of the problems, induced that the E method was the method for these problems, or, an extreme case, the puzzled subject might have thought, "These problems are all the same. Why this is so I do not know. There must be some reason for it of which I am not aware, because it is improbable that through a random selection of problems, each time the same type of problem would occur. Since this is so unlikely, and since these problems have been similar, it is probable that the same type will occur again." Thus, the improbability of succession of E problems furnished the subject with reasons for continuing with the E method.[46]

Experiment 2

What would happen if only one E problem were given?

A class of 22 college students was told to formulate, for the sake of an experiment, problems in which one had to measure a given amount of water by two or three jars. After 20 minutes we collected the papers and, pretending to read their problems, we presented E_1, C_1, C_2, #9, C_3, C_4. The E-Effect practically disappeared. Only one subject used the E method in C_1C_2.

C_1C_2: 5% E C_3C_4: 0% E #9: 0% F.

The comments of the subjects were very revealing: the subjects, with the exception of two, were testing each problem to see if there were a solution to it; each problem they viewed separately, never thinking of rules or types of problems. The other two had become suspicious because all the problems had three jars in them—one subject tried to

[46] This is quite different from the probability expectations on the roulette wheel, and similar chance games. If red should reappear five times in succession, the gambler would stake his next bet on black, certain that it must appear after all the reds. Why in our cases may a contrary inference be drawn? Because in the roulette game one assumes safely that he is dealing with a "random machine," whereas in our situation it is possible, the subject may think, that certain reasons are governing the happenings, even if these reasons are not concretely realized by him. It would have been helpful to have questioned every subject after the experiment about his impressions of the problems, their succession, etc.

find if there was a sequence in the types of problems. He developed an Einstellung in C_1C_2 but recovered in #9.

Perhaps the reasons we gave above for E-Effect in Experiment I—the operation of the uniform succession of E problems—may be valid, since here, with only one E problem, the E-Effect was very small.

Conclusions. In all the experiments in Section 14 and the first experiment in this section, the results were similar to those of the general experiment. Yet this is not conclusive proof that suggestion, prestige, and confidence play no role in the E phenomena. We have dealt here with certain kinds of suggestions, prestige, and confidence, for example, with the personal prestige factor. We may have shown that the material uniformity of the set of problems—five successive E problems—was a stronger factor than the specific personal prestige of the experimenter. It may be the "suggestion" of the set of problems which was operating; i.e., the uniform succession of problems may have suggested to the subject that this type will continue to be given.

We do not know whether the prestige will not play a more influential role should the set-up be changed to only one E problem, should personalities different from those already studied be permitted to administer the experiment, should different kinds of subjects be studied. We do not know how influential or uninfluential these factors might be in various social situations; atmosphere of drill, an examination atmosphere, an atmosphere which demands slavish behavior versus one which permits free-looking, undictated behavior (Autocratic versus Democratic atmospheres). We have started experiments of this kind on which we hope to report soon..

Chapter VIII

Some Remarks Concerning the Hypotheses

The results of the preliminary experiments indicate, thus far, with regard to the hypotheses:

Hypothesis I (page 29) in itself does not suffice. The mere postulation of a general law of Einstellung—if viewed as advisable—is not enough. Hypothesis II (page 29) seems more appropriate; for we have found that, although E-Effects are very strong, internal and external conditions are relevant in bringing about E-Effects and have to be taken into account.

Such factors in the experiment as attitudes, social field conditions, and the like, seem to play an important role. Effects externally similar to acting in a blinded, mechanized fashion are often brought about, without such mechanization, on the basis of assumptions and interpretations on the part of the subject.

The factors mentioned in hypotheses II to V (pages 29 to 30) seem at work; as the experiments of Chapter VII are merely preliminary, and as other variations are to be tested, further experimentation is required before any conclusive decision can be made with regard to the hypotheses.

The next necessary step seems to be investigations into the actual attitudes of individual subjects and of groups, and related investigations on the influence of "atmosphere."

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Basically various phenomena appear to be involved in the overtly similar E reactions, the two extremes being:

1. *Phenomenon I.* The subject is in the criticals radically blind to the D possibilities, acts in a kind of perseveration, is compelled to repeat automatically the E procedure, is robbed of all freedom of thinking about another way. He is greatly surprised and shocked when he is later shown how easily the criticals can be solved by a D method; and sometimes just refuses to believe that these are the problems on which he has worked. Realizing it, he is embarrassed by the blindness and stupidity he showed while solving them; puzzles how it was possible; and feels shame at having been blinded to such a degree, rendered so incapable of reasonable action, of intelligent procedures.

2. *Phenomenon II.* The other extreme we found rarely, but in some of the experimental variations it seemed to become the rule. The subject, although he gives the E response, is more or less aware of the D possibilities. He gives the E response for certain reasons, believing, for example, that the five E problems give the character of all the problems in the series, or that the experimenter wants to furnish practice in the E method, and so the criticals also should be solved in the E way, interpreting in one way or another the supposed wishes of the experimenter. Such a subject is afterwards not in the least surprised to hear of the D possibility; he may remark simply that the D method was not asked for; he evinces no shame at not having used the D procedure[47]—all this presenting a picture very different from mechanization.

If in such cases the number of tasks of

[47] Instead of viewing their responses as stupid, some of these subjects remarked heatedly that the tasks or the instructions were stupid.

type nine (extinction tasks) is increased, the subject may easily become doubtful about his inductions or assumptions and readily adopt the use of the direct methods in subsequent criticals.

[Still, the behavior described in Phenomenon II differs widely from the behavior shown by those subjects mentioned in par. 3 of page ooo who felt not at all compelled to repeat what they had done before but had the attitude of looking at each problem for the appropriate way to deal with it, not swerved from this attitude even after in several successive problems the same method worked.]

Remarks indicative of Phenomenon II when made at the close of the experimental session, after the D method was illustrated, may have been rationalizations.[48] Too proud or too conceited to admit "blindness," the subject may have excused himself by saying that he had seen the D possibilities but had refused to use them; whereas, in fact, he had been mechanized and not aware of the D method. Thus the subject's qualitative reactions may not always be a proper basis for discrimination between Phenomenon I and Phenomenon II. A few individually conducted experiments, however, gave clear evidence for the occurrence of Phenomenon II, without any basis for suspecting rationalization. Immediately after a test problem was presented, these subjects responded explicitly in the manner described in Phenomenon II; in the extreme cases they noted the D possibility but added, "Obviously I have to use the other (E) method here" or "You expect me to use the (E) method—why do you give here a task which is more easily solved in another way? Is this an error in your set?" Without any doubt, they acted not at all like those subjects who manifested Phenomenon I.

Between these two extremes there are many intermediate cases, some a mixture of Phenomena I and II. We shall describe a few of these cases:

a. We found subjects who assumed that they were to be given very difficult and hard problems. They were like the Ph.D. candidate, who awaiting the deep, profound questions of his examiners, is asked a very simple question and is stumped by its very simplicity. Not aware that such an obvious answer will do, he fails to give or perhaps even to see the simple answer. So did these subjects react to the test problems. Some of them were aware of the D methods but did not use them, certain that such simple solutions "would not do." Others were so taken in by their belief that these were difficult problems that they did not even notice the D methods.

b. The subject first assumed or induced that the E method should be used; after a while the numerous repetitions of the E method developed in him a tendency to repeat it mechanically; no longer did he use the E method because he was thinking that it should be used, but rather, because he was carried along by a mechanical repetitive tendency.

c. Some subjects, particularly college students, were evidently bored by the entire experiment, not very much interested in the problems nor in their solutions to them. After seeing that the E method worked in the first problem or two, they repeated it in the subsequent ones, scarcely looking at the problems, dealing with the tasks in a cursory manner, with a superficial attitude, not wishing to waste too much effort on such childish matters.

[48] In some instances, during the experimental session, before the D method was illustrated, subjects wrote comments on their papers or called us over and made remarks which indicated Phenomenon II.

Neither Phenomena I nor II, though for different reasons, can really be termed intelligent when contrasted with the behavior shown by those subjects mentioned on page 4 (*Experiments with College Groups*) who had just the attitude of looking at each problem for the appropriate way to deal with it, not swerved from this attitude by external assumptions or by mechanization. In both Phenomena I and II a mechanical tendency or an assumption or induction takes the place of directly looking at the actual situation to learn what it intelligently requires. Notwithstanding that in many cases it may be advisable to act on the basis of such an assumption, or very practical to develop automatic mechanization, there is involved the danger of materially inadequate reactions.

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As it seems necessary for theoretical reasons to investigate the basic differences in the attitudes of the subjects, it seems no less important, for practical reasons, to study what are the actual educational conditions which favor or disfavor the blinding effects; for we have seen that the resulting E-Effects were generally great and, in some cases, recovery from the Einstellung not easily obtained.

Chapter IX

Educational Implications

Hypothesis V C (page 30) makes the point that E-Effects may be due to the subject's carrying over to the experiment attitudes developed by certain kinds of schooling. In the subsequent paragraphs we shall briefly describe certain school situations and indicate how they may have affected the results. These formulations are based on the qualitative results—our observations and impressions while conducting the experiment, comments of the subjects, discussion with teachers, etc. By no means is the following an exhaustive treatment of the influence of pedagogical practices on Einstellung responses.

1. In most of the public school classes in which this experiment was conducted, the teacher, after introducing a new procedure, rule, or formula, gives a series of assigned tasks. The pupils practice the just taught method in quite a number of cases. Exact and accurate reproduction (application) of what the teacher taught is the aim.

Since our experimental set-up has some similarities to such a lesson, some of the children may have regarded it as such, and "practiced" in the problems the method shown or discovered in E_1. If they realized that the E method did not give the answer to Problem Nine, they may have thought that they applied it incorrectly or that the experimenter had given the wrong example. They were not accustomed to being taught one method and expected to seek for, or use other methods. "You did not teach us that method," or "You should have shown the other way, too, if you wanted us to use it," some children remarked when the D method was later shown to them. DBB may have been a meaningless phrase, or may have been interpreted to mean, "Let us see how well or quickly you can learn to use the method."

2. Many of our subjects, both in the college and in the elementary schools, because of their school training viewed arithmetic as composed of a heterogeneous manifold of definite facts and operations, of fixed habits and skills; one must always try to remember the particular rule, formula, or method which works in any given type of arithmetical problem. In our experiment, a subject may have sought to find the "rule" or "trick" which solved the type of problem. He treated the E method as "the rule" for the problems. If he realized that Problem Nine was not solvable by the formula, he may have regarded it as an hard example, as an error on the experimenter's part, or may have written that the answer was 42 and not 25. DBB may have meant to these subjects, "Don't be blind to the method which solves the problems" or "Don't be blind to the fact that all are of the same type; the same trick works in all."

3. Although we explicitly said that the experiment was not an examination (test), many children clearly took it as such a test. They made comments as, "When will we know our marks?"; "The test was hard. I was frightened"; etc. When the experiment was viewed in such a way, certain attitudes toward school tests may have been carried over to it.

a. In school one may have learned that in assigned tasks and in tests one

must repeat what one was taught before. Similarly, the subject attempted to repeat in the problems of our experiment what he had learned in the E tasks.

b. On most school tests, one knows that one is not marked on the kind of process used to derive the answer. Thus, as long as the E solution gave an answer, no other questions arose. Problem Nine was an example one got wrong; or a trick example. The Instruction DBB may have been taken as an additional test item, some words one must not forget to write.

c. Since a child's status in school is to a great extent determined by tests, they have come to play important and awesome roles in some children's lives. Those who were fearful of failure in our "test" and noticed that the E method solved the first few problems, clutched at it as a means to save themselves. In such a state of mind they were not prone to leave what they knew for what they did not know. Fear so narrowed their mental fields that they failed to see the direct method and continued to use the E method throughout. After Problem Nine, one is glad that the E method again is easily applicable. DBB may have added to the confusion and fear: what does it mean?

The subjects who were not frightened but were desirous of showing how clever they were by finishing quickly, showed the speed influence (see page 56). They were in no state of mind to weigh and consider methods of solution. DBB may have meant, "Be clever. Show how quickly you can solve the problems."

The question may well be asked whether or not the frequent testing to which the subjects, as students or former students, are or were submitted, has developed a superficial attitude toward problems. One is not interested in the problem itself; one does a problem to get a mark, to show how quickly one can get through; the thing is to get by—to pass. Such a superficial relationship to tasks, when carried over to the present experiment, may have resulted in an attempt to solve the problems by the method that was at hand. An attitude of "I finished first," etc., is not conducive to free examination of a problem.

4. When, after the experiment, the D method was shown to the subjects, there were, at times, protests: "You taught us wrong"; "You did not tell us to use the D method"; "You fooled me"; "It's a trick, I never expected to be tricked"; "I did what you told me to do"; "I tried to do everything you showed." Discussion with subjects who made such comments, and our observations of the classrooms, lead us to suspect that the pupil-teacher relationship may have influenced the subject's attitude toward the experiment. It should be remembered in this connection that to all children and to some adults the experimenter was a teacher and the experiment a school activity.

a. In some classes the relationship of the children to the teacher seemed to be that of followers of a master. Some of the teachers proudly informed us that their children were very good, saying that they "always did exactly as told."

Such a relationship may focus the child on guessing "what teacher wants," instead of examining freely the task at hand to see what solution it requires. The child tries to guess and do just what teacher wants done in the problem. Thus, believing that the experimenter wanted him to use the E method, he may have tried to use it throughout. Problem Nine may not have helped but merely confused him since he could not do what he thought the teacher wanted. DBB may have meant, "Be on the alert to do,

also in the following examples, what the teacher demands."

b. In some classes we observed an absolute confidence in the teacher in these regards. Teachers do not fool or trick you; they always tell you what you should do, and for your own good it's best to do it. Whatever the teacher says (or seems to say) is the correct thing. Do as she did, and everything will be all right. There is no reason for free initiative.

Such attitudes toward the teacher when transferred to the experimenter may have played a role in E-Effects. Failing Problem Nine, such pupils may never have suspected that there was another method of solving the test tasks but may confusedly have thought that they, unfortunately, were not able to discover how to do this problem in the E way. For real effectiveness of Instruction DBB, it would have had to mean for them to be suspicious of the method, problems, teacher—behavior which in the classroom situation was foreign to them.

5. We have mentioned some specific school procedures which may have contributed to the results. We had the impression that the entire general "social atmosphere" which existed in the classroom, a result of many factors, was sometimes important in producing the responses.

a. In some classes there was clearly an atmosphere of fear, tension, and tense competition. That such conditions may favor Einstellung responses has been noticed in the experiments (pages 49-53).

b. In many of the public school classes in which we conducted the experiments much of the child's behavior was circumscribed by fixed rules and procedures. Restraint, pedantry, obedience, submissiveness were desired traits. As a result of these factors, we believe, conditions and attitudes may have been created which furthered Einstellung responses and made for little or no recovery. Some classes in which we conducted the experiment (e.g., Pr.El. classes and P.S. C 6B[1]) were outstanding for their lack of such an atmosphere and for the high degree of freedom and ease which seemed to prevail. The teachers of these groups employed "modern," "progressive" methods of teaching. These classes showed somewhat less Einstellung and better recovery than most of our elementary school groups. Because of differences in I.Q. the theoretical situation is not conclusive (see page 21). The problem of differences in Einstellung and Recovery Effects in truly progressive schools as compared with rigid drill schools needs thorough investigation.

What could be done in school procedures if one wants to avoid "blinding" effects of Einstellung? We formulate some suggestions, the efficacy of which, of course, would have to be tested in actual teaching situations.

1. A change in the set of "assigned tasks": After illustrating a method the teacher would not present a series of problems all solvable by the same procedure; she would intersperse problems which are not solvable by the just before taught method, telling the pupils that the assigned tasks will not all be of the same type, but will sometimes have other methods of solution. In this way the child may be induced to examine the problem instead of merely repeating without looking at the problem's requirements. In connection with this suggestion see the following preliminary experiments: Alternating E and Non-E Tasks (page 41), Alternating Criticals with E Tasks (page 41), Presenting Problem Nine Earlier in the Experiment (page

41), Discussion before Repeating the Experiment (page 80), Clarification Before the Experiment (page 77).

2. Demands for *speedy instantaneous responses* may create conditions favorable to "blind" responses (see "Speed Experiments," page 53). It is certainly true that certain processes have to be reduced to quick, ready responses, but, to focus all teaching on the production of such responses may mechanize the child. He may as a result of such teaching be able to give instantaneous responses in the drilled material, but not be able to solve new application tasks. In contrast, the child would in appropriate tasks be given time, would even be encouraged to think clearly himself, to weigh the problems before answering; and avoiding quick responses would rule out some of the competition.

3. On tests, not only the correctness or incorrectness of the final result but also the method of deriving the answer should be considered.

4. Not merely ability to reproduce what the teacher said or what the child read should be tested but interesting tests should be used in which some creative activity is demanded from the child, new situations in which the child cannot simply apply what he was taught but has to find ways himself.

5. In order to minimize the emotional and social conditions resulting from tests, the child should be made to realize that tests are not merely means of grading him but means of help—means to find out productively what further instruction or other assistance is required.

6. A "Democratic" atmosphere would probably prevent the development of the kind of teacher-pupil relationships and the social field conditions which we mentioned before.

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This study should not be taken to controvert the values of habits. Exercise and even drill have their values. Mechanized responses have a place in one's behavior. They possess the advantages of releasing one from the bother of finding anew responses to recurring everyday situations, they equip one with precise, ready, and speedy responses to certain aspects of his environment; and they free the mind so that it can more adequately deal with complicated tasks. What the study has shown is that in mechanization there are certain dangers. When the individual does not adequately deal with problems but views them merely from the frame of reference of a habit; when he applies a certain habituated behavior to situations which have a better solution or which, in fact, are not even solvable by the just working habit; when a habit ceases to be a tool discriminantly applied but becomes a procrustean bed to which the situation must conform; when, in a word, instead of the individual mastering the habit, the habit masters the individual—then mechanization is indeed a dangerous thing.

We would consider our efforts well spent if this is realized; and if educators attempt to develop methods of teaching which possess the advantages of widely used methods but not their disadvantages. Methods are needed which will teach the child to stand on his own feet, to face the world freely and act through intelligent thinking rather than by blind force of habit.

APPENDIX I

In a number of the experimental variations reported on in Chapter VII, other problems were used in conjunction with, or in lieu of, some or all of the usual E and test tasks.

1. After the five usual E problems, additional E tasks were presented to the subjects in Experiments 1 and 2 of Section 1, in Experiment 6 of Section 13 A, and in the individually-conducted experiments described in the Conclusion, Section 13 B. In all cases the E problems were taken from the following list:

E_6	13	83	28	get	14
E_7	56	90	12		10
E_8	43	93	20		10
E_9	8	61	6		41
E_{10}	24	52	3		22
E_{11}	19	42	3		17
E_{12}	31	61	12		6
E_{13}	29	72	4		35
E_{14}	36	86	20		10
E_{15}	6	21	4		7
E_{16}	24	62	3		32
E_{17}	16	122	42		22
E_{18}	17	130	35		43
E_{19}	5	67	20		22
E_{20}	20	98	14		50
E_{21}	15	144	21		87
E_{22}	9	83	3		68
E_{23}	18	59	16		9
E_{24}	23	76	18		17
E_{25}	7	79	33		6

2. In Experiment 2b of Section 13 B new E and test tasks were used. The E and D methods, however, were unchanged; as in the general experiment the E method was $B-A-2C$, the D methods $A-C$, $A+C$.

Illustrative Problem	68	3		get	62
E_1	13	119	3		100
E_2	12	144	21		90
E_3	43	93	20		10
E_4	8	61	6		39
E_5	24	52	3		22
C_1	19	42	4		15
C_2	10	32	4		14
#9	17	54	4		13
C_3	13	41	5		18
C_4	12	32	8		4

3. In Experiment 3 of Section 8 and Experiment 2c of Section 13 B, a new set of problems was presented which required new E and D solutions. The E method was $A+B-4C$, the D method $B-A-C$.

Illustrative Problem	6	140	8	get	106
E_1	4	120	5		104
E_2	3	72	10		35
E_3	7	160	15		107
E_4	8	62	3		58
E_5	9	96	4		89
C_1	9	84	6		69
C_2	3	88	2		83
#9	9	86	8		69
C_3	6	56	4		46
C_4	12	82	8		62

4. In Experiment 2 e of Section 13 B a new set of tasks was used which required new E and D solutions. The E method was $B-4C-A$ and the D methods $A+2C$, $A-2C$.

Illustrative Problem		96	3	get	90
E_1	21	100	9		43
E_2	33	62	2		21
E_3	18	69	5		31
E_4	22	90	7		40
E_5	26	75	6		25
C_1	39	84	3		33
C_2	24	72	4		32
#9	37	92	4		29
C_3	31	80	3		37
C_4	21	54	6		9

5. In Experiment 2 of Section 12 seven problems solvable by a $B-A-C$ method were followed by a critical solvable by this method and by A, the filling of one jar.

E_1	4	12	5	get	3
E_2	3	12	4		5
E_3	8	24	5		6
E_4	7	30	3		20
E_5	12	51	8		31
E_6	2	9	4		3
E_7	6	17	3		8
C'	2	12	8		2

Appendix II

Table 69

I.Q.'s of elementary school subjects of the general experiment*

Group	Control Group				Plain Group				DBB Group			
	No. of Subjects	Range	Mean	S.D.	No. of Subjects	Range	Mean	S.D.	No. of Subjects	Range	Mean	S.D.
P.S. A	91	65–129	93.43	14.07	121	70–134	103.78	15.75	106	70–164	111.65	15.75
P.S. B	91	70–134	99.08	10.56	128	75–164	102.60	13.61	110	75–134	104.20	13.25
P.S. C	265	65–144	103.24	11.34	158	70–139	104.85	15.25	159	75–139	108.90	14.62
Pr. El.					13	120–149	132.62	2.84	16	110–159	138.10	2.16

* Based on National Intelligence Tests.